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ABSTRACT

One of 11 guides intended for use at the junior high school level of career exploration, the document identifies job families within the natural resources and environmental occupations cluster, identifies occupations within each family, and gives suggestions for possible classroom experiences, references, and evaluations. The guide is divided into five units: (1) an orientation to occupations in natural resources and environment, (2) a definition of the cluster area, (3) an overview of the occupational cluster, (4) educational opportunities in natural resources and environment, and (5) an evaluation of self in relation to a career in the cluster area. Each unit specifies unit purpose and objectives and includes an outline of unit content, teaching-learning activities, evaluation techniques, and suggested resources. Related instructional materials include reference lists, charts, sample forms, and classroom activities. Over 100 pages of the appendix are devoted to occupational briefs. Also included in the appendix are: a list of occupational titles, a content outline of job families, and a list of publishing companies. (MW)

# EXPLORING CAREERS

# IN

# NATURAL RESOURCES AND ENVIRONMENT:

# A GUIDE FOR TEACHERS

ED 098 420

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July 1974

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## PREFACE

Career education may be described as a program of systematic educational experiences which prepares students for economic independence and personal fulfillment. Such a program should focus on the development of knowledge, general and specific abilities, and the awareness of the values of a work-oriented society; assisting all individuals--at all educational levels and ages--to interact with the economic sector.

Career education includes vocational training, but it is more than this. It aims toward developing the total individual; i.e. an individual able to perform all of his life roles with the skill, knowledge, and understanding necessary for success in all of these roles. It aims at developing the self-motivating and self-fulfilled individual who is a constructive force in the maintenance and improvement of the social body of which he is a part.

To meet the needs of individuals of all educational levels and ages, five phases of career education need to be implemented: awareness, orientation, exploration, preparation, and adult and continuing education.

Career awareness, emphasized early in the career development program, is to lead the individual in developing certain fundamental attitudes toward himself, toward other people, and toward work. Career orientation and exploration--emphasized in the middle school years--provides appropriate educational experiences which enable the individual to become familiar with the economic system and which allow the individual to explore various occupational clusters, to obtain initial work experience, and to integrate work values into his personal value system. The career exploration phase

places equal emphasis on exploration of specific occuaptional clusters and on the relevancy of academic subject matter to career goals. During the preparation phase, which may begin at grade ten or later, the individual narrows his choices of careers and prepares to enter the labor market or to continue his education. The purposes of adult and continuing education are to assist in the individual's advancement and to aid adults in discovering, analyzing, and preparing for new careers.

Accepting the philosophy underlying career education probably means change for the educator and the educational system; it certainly means additional planning and organizing. Adopting this new concept could mean adding totally new programs, changing present programs, training new personnel, and/or developing new courses of study.

To say that education must change is one thing; implementing that change is something else. This guide, "Exploring Careers in Natural Resources and Environment" is one of eleven such guides (including "Orientation to the World of Work," an introduction to all the guides) which can be used as a resource for teachers in implementing the exploration phase of career education in the middle/junior high school.

The following are suggestions for implementing this guide:

(1) It can be used as one of the eleven guides as resource material for a series of mini-courses or activity courses, each dealing with a separate occupational area or cluster.

(2) It can be used as a resource to integrate career exploration activities into the existing curriculum.

In either option, this career exploration cluster guide can provide a valuable resource for student exploration of the Natural Resources and Environment cluster.

# INTRODUCTION

## Purpose of the Guide

This teacher guide is designed primarily for use at the middle school or seventh, eighth, and ninth grade levels. However, it may serve as a useful aid in other educational settings such as high schools, vocational schools, or public placement and counseling agencies.

The guide suggests a wide range of experiences which are designed to take the student from wherever he is and move him progressively toward the goal of vocational maturity and a career choice.

The guide can serve as a nucleus for group instruction relating to the cluster of natural resources and environment. It is designed primarily for career exploration on the part of the student under the supervision of the teacher. Although the material is primarily geared to group instruction, it is hoped that through the proper counseling and teacher guidance the students will personalize all of the learnings, thus resulting in a better self-understanding in relation to the world of work.

## Suggestions for Using the Guide

The utilization of this guide will be greatly enhanced if the team approach in teaching is practices whenever possible. Counselors, vocational teachers, general education teachers, and work experience coordinators should all be involved if the guide is going to benefit all students to the utmost.

The guide may serve as the curriculum base on which to implement a totally new program in career education or it may give insights into the

strategy to follow when implementing career education concepts relating to natural resources and environment into an ongoing program.

The units in the guide deal with activities in which the teacher must involve the student in exploring the cluster area of natural resources and environment. In many situations it is suggested that a student or a group of students experience a certain activity or view a certain work role. Each time students view or experience a certain activity or work role, they should be encouraged to share with other students:

(1) Their observation of job conditions and performance.

(2) Their own feelings while observing or performing the activity or work.

(3) The personal attitudes or needs which they feel would be limited by such work.

(4) The aptitude and abilities which they feel they have or may not have for such work.

Group involvement and interaction will result in a better understanding of the cluster area of natural resources and environment.

The Appendix of the guide contains occupational briefs, job titles, and a content outline of the job families. These materials are designed to give the teacher a better base from which to aid the student in exploring natural resources and environment. The occupational briefs describe job characteristics, qualifications, employment prospects, and advancement opportunities for numerous jobs in the cluster area. They may be used as student reference material. The content outline furnishes specific information concerning all job families in the cluster area. This material will become very valuable as the student, under teacher supervision, begins to explore the area of natural resources and environment.

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UNIT ONE

ORIENTATION TO THE EXPLORATION

OF

OCCUPATIONS IN NATURAL RESOURCES AND ENVIRONMENT

UNIT PURPOSE: To provide an occupational background study before focusing on occupations in natural resources and environment.

PERFORMANCE OBJECTIVES: The student will be able to

I. Distinguish between occupation, job and career.

II. Explain the reasons why people work.

III. Identify information that should be obtained when considering various occupations.

IV. List various occupations that are found in the community or state.

V. Construct a natural resources and environment resource file.

I. The student will be able to distinguish between occupation, job, and career.

A. Suggested Content

1. Definition of the term occupation

a. Principal employment role of one's life

b. Principal business or vocation of one's life

c. Activity in which an adult spends the most of his working time.

2. Relation of the term occupation to jobs

a. Occupations are made up of specific jobs.

b. What a person does specifically within an occupation is his job.

c. Examples of jobs within occupations

| Occupation | Jobs |
|---|---|
| Tobacco Farmer | Transplanting<br>Spraying<br>Cultivating<br>Harvesting |
| Plumber | Install waterlines<br>Unclog drain<br>Hook-up water heater<br>Install bath fixtures |
| Teacher | Lesson planning<br>Lesson preparation<br>Lesson presentation<br>Student evaluation |

3. Relation of the terms occupation and jobs to careers

a. A career is the sum total of the work (occupations and jobs) done by a person in his employment lifetime.

b. Career refers to a meaningful progression in a person's working life.

c. Examples of progression within a career

| Career | Occupations |
|---|---|
| Politics | Lawyer<br>County Judge<br>State Representative<br>Governor<br>U. S. Senator |

d. A career differs from an occupation in that the occupation at that time is a part of a career.

e. One's career begins in the very early years and continues beyond the time one retires from a position of paid employment.

B. Suggested Teaching-Learning Activities

1. Involve the student in obtaining two definitions of the term occupation and career from two possible sources.

2. Play the game "Pop-up." Instruct the student that the teacher is going to call the names of class members at random. When a name is called the student is to pop-up within ten seconds and give the name of an occupation. You may want to divide into teams and award a prize to the team who gives the most occupational names while playing the game "Pop-up." If jobs are given rather than occupations, take time to discuss the differences.

3. Show the transparency NRE-1, "The Definition of Occupation and The Definition of Career," page 18, and conduct a student discussion of the definition of the term occupation and the relation of an occupation to a career.

4. Divide the students into teams of two. Assign one occupation to two or more teams. Involve each team in identifying all the possible jobs within that occupation. Compare the results obtained by the teams.

5. Involve each student in describing or role-playing the occupation of his or her parents. Have the student bring to class items used by his or her parents in their occupations.

6. Form an occupational tree or occupational display. Items to be included on the tree or in the display should be items used in the occupations of the students' parents.

7. Form a career tree display. Choose a career area and list and illustrate occupations in that area.

8. Develop a bulletin board that depicts the various occupations in the community.

9. Play the game, "What's My Occupation." Base the game on the concept of the television game, "What's My Line." Information to be used for the game can be found in the occupational briefs on pages 149-265.

C. Suggested Evaluation

1. Prepare a list of occupations on one side of the chalkboard or paper, on the opposite side list at least three jobs done in each occupation. Have the students match the jobs to the occupations.

2. Have each student tell the class orally or put in writing his definition of the terms occupation and career.

3. Choose an occupation that might be considered the climax of a particular career area. Ask each student to list in a logical sequence the various occupations or jobs one might have in working their way to the stated occupation. Point out that the total of these occupations is the career of that individual.

4. Prepare a list of career areas. List numerous occupations. Have the students separate the occupations into the proper career areas and then list the occupations in a logical progression sequence.

D. Suggested Resources

1. Books

   a. Career Education in the Middle/Junior High School, p. 22 and 28.

   b. Career Guidance: Who Needs It, Who Provides It, Who Can Improve It, p. 7.

   c. Dictionary

   d. Encyclopedia

2. Transparency Master NRE-1, p. 18.

II. The student will be able to explain the reasons why people work.

A. Suggested Content

1. Basic reasons people work

a. Provide for the necessities of life for oneself and family

(1) Food
(2) Clothing
(3) Shelter

b. Express creativity

(1) Artistry
(2) Designing
(3) Writing

c. Provide for the luxuries of life

(1) Color television sets
(2) Boats
(3) Campers

2. Other reasons people work

a. Provide security

(1) Regular income
(2) Insurance
(3) Retirement benefits
(4) Vacations

b. Provide the opportunity to associate with others of similar interests

c. Receive experiences that will permit advancement

(1) Recognition for achievements
(2) Job-occupational promotions

d. Satisfaction of being able to work and be a contributing member of the community.

B. Suggested Teaching-Learning Activities

1. Invite the principal, another teacher, or guidance counselor to the class to discuss why they work in their particular occupation. Allow ample time for student discussion and questions.

2. Select a student who has been involved in work experience activities and have him or her share with the class their work experiences on a particular job within an occupation.

3. Involve the student in discussing with his or her parents at home why they work in their particular occupation. Instruct the students to bring back to class five reasons why their parents work. Discuss these reasons in the classroom setting.

4. Show and discuss the transparency NRE-2, "Reasons for Working In An Occupation," page 19. Involve the student in adding additional reasons to the list.

5. Involve the student in making a list of the goods the student's family uses. Divide this list into necessities and luxuries. Put a list on the board. Relate these goods to why people work in an occupation.

6. Hold a speaking contest with the topic being "Why Work." Select the top five speakers and speeches in the class. Hold a final contest with outside judges and give a prize to the winner.

C. Suggested Evaluation

The student will list and discuss in writing four reasons why he will work in an occupation. Evaluate these reasons in relation to how well the student explains the concept of why people work.

D. Suggested Resources

1. Resource persons

   a. Principal

   b. Teachers

   c. Guidance counselors

2. Books

   a. I Find My Vocation, Ch. 4.

   b. Occupational Information, Ch. 1.

   c. Occupations and Careers, Ch. 6.

3. Transparency Master NRE-2, p. 19.

III. The student will be able to identify information that should be obtained when considering various occupations.

A. Suggested Content

1. Information to secure

a. Employment outlook

(1) Present
(2) Future

b. Nature of the occupation

(1) Duties performed
(2) Advantages
(3) Disadvantages
(4) Working conditions

--Salary
--Hours
--Fringe benefits

c. Personal qualities required

(1) Interests
(2) Physical abilities
(3) Mental abilities

d. Qualifications for employment

(1) Formal education
(2) On-the-job training
(3) Previous work experience

B. Suggested Teaching-Learning Activities

1. Involve the students in making a list of the information they would like to secure concerning any occupation of their interest. Compile a final list on the chalkboard and discuss.

2. Simulate an employer-employee setting. Involve the teacher, guidance counselor, or student in being the employer with a student serving as the prospective employee. The student should be responsible for asking questions concerning information he would like to receive pertaining to the occupation for which he is being interviewed.

3. Invite a high school student or a student in the class who has been interviewed for a job to discuss with the class the questions that were asked the employer and the questions the employer asked.

4. Invite an employer from a business to the class. Involve this individual in relating the informative topics he usually discusses with a prospective new employee. Allow ample time for student questions.

   Note: This individual could possibly be a parent of one of the students.

5. Conduct a discussion while showing transparency NRE-3, "Needed Occupational Information," page 20.

C. Suggested Evaluation

The student will write a brief paper, "What I Need to Know About An Occupation." Evaluate the paper based on the number of different informational facts included in the content.

D. Suggested Resources

1. Resource persons

   a. Guidance counselor

   b. Community businessmen

   c. Parents

2. Books

   a. Handbook of Agricultural Occupations, Ch. 1.

   b. Occupational Information, Ch. 3.

   c. Your Future in Agriculture, Ch. 1.

   d. I Find My Vocation.

3. Transparency Master NRE-3, p. 20.

IV. The student will be able to list various occupations that are found in the community or state.

A. Suggested Content

1. Occupations of many types are present in most communities

2. Examples of different occupations

a. Occupations related to business and office

(1) Clerical occupations
(2) Secretarial occupations
(3) Management occupations
(4) Business ownership occupations

b. Occupations related to marketing and distribution

(1) Management occupations
(2) Supervision occupations
(3) Marketing occupations

c. Occupations relating to construction

(1) Carpentry occupations
(2) Painting and decorating occupations
(3) Masonry occupations
(4) Plastering occupations

d. Occupations relating to transportation

(1) Land transportation occupations
(2) Water transportation occupations
(3) Aerospace transportation occupations

e. Occupations relating to natural resources and environment

(1) Air
(2) Chemicals and radiation
(3) Fish
(4) Health
(5) Land use
(6) Minerals and mineral fuels
(7) Noise
(8) Parks and natural areas
(9) Range
(10) Recreation
(11) Soil
(12) Solid waste
(13) Water
(14) Wildlife

f. Other occupations in the community or state

B. Suggested Teaching-Learning Activities

Note: The teacher should guide the student to recognize that many occupations are available within the community or state, and that one primary area where occupations are available is in natural resources and environment.

1. Select students in the class whose parents have different occupations, being sure to select a student whose parents are employed in natural resources and environmental occupations. Involve the student in role playing the particular occupation. If role playing is not desired, involve the student in discussing the various occupations.

2. Form a panel of resource people from different occupations within the community, being sure to select a person or persons from natural resources and environment. Have the resource pelple discuss their occupations. Suggest that the resource people dress as if they were on the job and that they bring to class with them various items that they use on the job.

3. Involve the students in developing a display of the occupations with which they are most familiar. Actual items, pictures, etc., may be used in the display.

4. Divide your students into teams and have them design a poster that includes a listing of the occupations found in the community or state. This poster can be illustrated, printed free hand, or lettered with stencil letters.

5. Divide the students into teams and have each team responsible for developing a poster relating to one occupational area. Included on the poster can be jobs within the occupational area, newspaper clippings concerning the occupational area, etc. Emphasis should be placed on developing a poster relating to natural resources and environmental occupations.

6. Involve students in drawing illustrations or taking pictures of people in different occupations. Students can develop an occupational scrapbook.

7. Show transparency NRE-4, "Occupational Areas," page 21, and conduct a discussion.

Note: Upon conclusion of these four objectives the student should be oriented to the term occupation, why people work in an occupation and should be able to identify different occupations within the community or state. They should at this point realize that natural resources and environment is a major occupational area of their community or state.

C. Suggested Evaluation

The student will complete the form, "Match the Occupation to the Occupational Area," found on page 22. Evaluate the student based on the number of occupations matched to the correct occupational area.

D. Suggested Resources

1. Resource persons

   a. Parents of students

   b. Community resource people

2. Books

   a. An Analysis of the Fifteen Occupational Clusters Identified by the U. S. Office of Education.

   b. Occupations and Careers, Ch. 5.

   c. I Find My Vocation, Ch. 11.

   d. Occupational Outlook Handbook.

3. Transparency Master NRE-4, p. 21.

V. The student will be able to construct a natural resources and environment file.

Note: Exploration of the natural resources and environment cluster cannot be accomplished without community involvement. Suggestions are presented for getting both the student and the community involved.

A. Suggested Content

1. People to get involved

   a. Parents
   b. Business people
   c. Resource people

2. Sources of information

   a. Professional associations
   b. Businesses

B. Suggested Teaching-Learning Activities

Note: Student involvement is the key to this objective. The student can become involved in writing letters, calling people, contacting businesses which would aid in the exploration of the natural resources and environment cluster.

1. Teachers should guide the student in getting parents involved by helping the student

   a. Compose a letter explaining the career exploration program and asking for their help. A sample letter may be found on page 23.

   b. Devise a form which would get parent response concerning their willingness to assist. A sample form can be found on page 24.

   c. Compose a thank-you letter to those willing to cooperate informing them of the date which they will be expected to talk to the class or be visited on a field trip. A sample letter can be found on page 25.

   d. Accumulate a resource file of cooperating parents.

2. Teachers should guide the student in getting resource people in the community involved by helping the student

   a. Develop a list of businesses, agencies, and other sources of resource people in the area of natural resources and environment from the yellow pages, discussion, newspapers, or other sources.

b. Follow steps a through d as outlined in 1 above, except that parents would be changed to businesses or agencies in the community. The sample letters shown could be sent to businesses or agencies following minor modification.

3. Teachers should guide the student in securing materials from professional and business associations by helping the student

   a. Write letters to different professional associations asking for information concerning careers in their particular area. A list of professional organizations and their addresses may be found on pages 26-28.

   b. Write for booklets, brochures, or leaflets from businesses or agencies in the area of natural resources and environment. A list of businesses and agencies and their addresses can be found on pages 29-30.

   c. Make a display or a resource center of career exploration materials as they come into the classroom.

4. The teacher may want to divide the class into committees or teams, each responsible for a particular area or task.

C. Suggested Evaluation

The students as a group or as committees will develop a display or resource center of career materials in natural resources and environment. This display or resource center can be evaluated for adequacy of development.

D. Suggested Resources

1. Resource persons

   a. English teacher

   b. Business teacher

   c. Vocational agriculture teacher

# SUPPORTIVE MATERIALS FOR UNIT ONE

## REFERENCE LIST FOR UNIT ONE

Books


1. An Analysis of the Fifteen Occupational Clusters Identified by the U. S. Office of Education, Grayson County College, Sherman/Denison, Texas.

2. Career Education in the Middle/Junior High School by Rupert N. Evans, Kenneth B. Hoyt and Garth L. Mangum, Olympus Publishing Company, 1973.

3. Career Guidance: Who Needs It, Who Provides It, Who Can Improve It by Eli Ginzberg, The McGraw-Hill Book Company, 1971.

4. Handbook of Agricultural Occupations by Norman K. Hoover, The Interstate Printers and Publishers, 1969.

5. I Find My Vocation by Harry Dexter Kitson, The McGraw-Hill Book Company, 1954.

6. Occupations and Careers by Walter J. Greenleaf, The McGraw-Hill Book Company, 1955.

7. Occupational Information by Robert Hoppock, The McGraw-Hill Book Company, 1967.

8. Occupational Outlook Handbook by the U. S. Department of Labor, Bureau of Labor Statistics, Government Printing Office, Latest edition.

9. Your Future in Agriculture by Chester S. Hutchison, The Richards Rosen Press, Inc., 1965.


*Addresses of publishers can be found in the Appendix.

## DEFINITION OF OCCUPATION

A Word Used To Describe An Individual's Principal Employment Role In Life

The Activity In Which An Adult Spends The Majority Of His Time

Examples Of Occupations

| | |
|---|---|
| Doctor | Artist |
| Teacher | Lawyer |

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## DEFINITION OF CAREER

The Sum Total Of The Work Done By A Person In His Employment

A Word Used To Refer To A Meaningful Progression In A Person's Working Life

Example Of Progress In A Political Career

1. Lawyer
2. County Judge
3. State Legislator
4. Governor or U.S. Senator

# REASONS FOR WORKING IN AN OCCUPATION

## Basic Reasons:

1. Provide for necessities of life
2. Express creativity
3. Provide for luxuries of life

## Other Reasons:

1. Security
2. Give individuals an opportunity to
   a. Achieve
   b. Gain recognition
   c. Receive promotions
3. Enable individuals to associate with others
4. Satisfaction

# NEEDED OCCUPATIONAL INFORMATION

1. Present and Future Employment Outlook
2. Nature Of The Occupation
   a. Duties Performed
   b. Advantages
   c. Disadvantages
   d. Working Conditions
3. Personal Qualities Required
   a. Interests
   b. Physical Abilities
   c. Mental Abilities
4. Qualifications For Employment
   a. Formal Education
   b. On-The-Job Training
   c. Previous Job Training

# OCCUPATIONAL AREAS

1. Business and Office
2. Marketing and Distribution
3. Construction
4. Transportation
5. Health
6. Manufacturing
7. Consumer and Homemaking
8. Agribusiness
9. Natural Resources and Environment

## MATCH THE OCCUPATION TO THE OCCUPATIONAL AREA

Directions: Match the occupation on the left to the occupational area on the right. You may use the letters on the right more than one time.

| | | | |
|---|---|---|---|
| 1. | Secretary | _____ | A. Business and Office |
| 2. | Farmer | _____ | B. Marketing and Distribution |
| 3. | Carpenter | _____ | C. Construction |
| 4. | Doctor | _____ | D. Health |
| 5. | Salesman | _____ | E. Manufacturing |
| 6, | Florist | _____ | F. Consumer and Homemaking |
| 7. | Dietitian | _____ | G. Agribusiness |
| 8. | Painter | _____ | |
| 9. | Plant Manager | _____ | |
| 10. | Nurse | _____ | |

LETTER TO PARENTS

Dear _____,

We as a class are exploring the different careers in natural resources and environment. We understand that you are employed in this area. We need your help.

We would like to invite you to our class to discuss with us your occupation in the field of natural resources and environment. Please bring to class various items that you work with and, if possible, wear your work clothing.

Here are some areas which we would like for you to discuss:

1. What is your job title?
2. Where is the location of your place of employment?
3. What are the primary activities you engage in?
4. What is the primary function of your job?
5. Do you like or dislike your work? Why?
6. What is the general overview of your occupation in terms of working conditions, salary, etc.?

In the future we are also planning to take field trips. Would it be possible to visit you on a field trip?

Thanking you in advance for your help.

Respectfully,

RESPONSE FORM

NAME _____ PHONE _____

ADDRESS _____

OCCUPATION _____

I can _____ or cannot _____ visit your class to discuss my occupation.

I can visit the following days and times

| DAYS | TIME |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

You can _____ or cannot _____ plan a field trip to visit me in my occupation.

The best day and time for a field trip would be:

| DAYS | TIME |
|---|---|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

THANK YOU LETTER

Dear _____,

We appreciate your willingness to work with us in our career exploration program. It would not be possible to conduct such a program without the aid of individuals such as yourself.

We would like for you to visit our class _____date_____ at _____time_____.

Again we can only say thanks and we will be looking forward to hearing from you on the above mentioned date.

Respectfully,

Note: A similar letter could be used when planning field trips.

## SELECTED LIST OF PROFESSIONAL AND TECHNICAL SOCIETIES AND ORGANIZATIONS CONCERNED WITH NATURAL RESOURCES AND ENVIRONMENT

The following is a list of some professional and technical societies and associations concerned with conservation, natural resources, and environment which can be a source of useful instructional information and reference data. This is not a complete list and inclusion does not imply particular approval while omission does not imply disapproval of an organization. Educators and students desiring information from the organizations may address inquiries to the executive secretaries of each organization.

Air Pollution Control Association
440 Fifth Avenue
Pittsburgh, PA 15213

American Association of Nurserymen
835 Southern Building
Washington, DC 20005

American Congress on Surveying and Mapping
733 15th Street, N.W.
Washington, DC 20005

American Fisheries Society
1040 Washington Building
15th and New York Avenues, N.W.
Washington, DC 20005

American Forest Institute
1835 K Street, N.W.
Washington, DC 20006

American Forest Products Industries
1816 N Street, N.W.
Washington, DC 20006

American Forestry Association
1319 18th Street, N.W.
Washington, DC 20036

American Geological Institute
2201 M Street, N.W.
Washington, DC 20037

American Geophysical Union
2100 Pennsylvania Avenue, N.W.
Washington, DC 20037

American Institute of Planners
917 15th Street, N.W.
Washington, DC 20005

American Meteorological Society
45 Beacon Street
Boston, MA 02108

American Petroleum Institute
1271 Avenue of the Americas
New York, NY 10020

American Pulpwood Association
605 Third Avenue
New York, NY 10016

American Society for Horticultural Science
P.O. Box 109
St. Joseph, MI 49085

American Society of Photogrammetry
644 Leesburg Pike
Falls Church, VA 22044

American Society for Horticultural Science
615 Elm Street
St. Joseph, MI 49085

American Society of Agricultural Engineers
St. Joseph, MI 49085

American Water Resources Association
P.O. Box 434
Urbana, IL 61801

American Water Works Association
2 Park Avenue
New York, NY 10016

Association of Interpretive Naturalists
1251 East Broad Street
Cholumbus, OH 43205

Citizens League Against the Sonic Boom
19 Appleton Street
Cowbridge, MA 02138

Conservation Education Association
Box 450
Madison, WI 53701

Conservation Foundation, The
1250 Connecticut Avenue, N.W.
Washington, DC 20036

Ecological Society of America
Oak Ridge National Laboratory
Radiation Ecology Division
Oak Ridge, TN 37831

Entomological Society of America
5603 Calvert Road
College Park, MD 20740

Friends of the Earth (FOE)
30 East 42nd Street
New York, NY 10017

Grain and Feed Dealers National Association
500 Folger Building
725 Fifteenth Street, N.W.
Washington, DC 20005

Incinerator Institute of America
60 East 42nd Street
Suite 1914
New York, NY 10017

International Union for Conservation of Nature and Natural Resources
2000 P Street, N.W.
Washington, DC 20006

Institute of Environmental Sciences
35 South Main Street
Mt. Prospect, IL 60057

Izaak Walton League of America, The
1326 Waukegan Road
Glenview, IL 60025

John Muir Institute for Environmental Studies
451 Pacific Avenue
San Francisco, CA 94133
or, P.O. Box 11
Cedar Crest, NM 87008

National Audobon Society
1130 5th Avenue
New York, NY 10028

National Parks Association
1701 18th Street, N.W.
Washington, DC 20009

National Recreation and Park Association
1700 Pennsylvania Avenue, N.W.
Washington, DC 20006

National Wildlife Federation
1412 16th Street, N.W.
Washington, DC 20036

Nature Conservancy, The
1522 D Street, N.W.
Washington, DC 20005

Planned Parenthood/World Population
515 Madison Avenue
New York, NY 10022

Scientists' Institute for Public
Information
30 East 68th Street
New York, NY 10021

Sierra Club, The
1050 Mills Tower
San Francisco, CA 94104

Society of American Foresters
Suite 3000
1010 16th Street, N.W.
Washington, DC 20036

Society for Range Management
2120 South Birch Street
Denver, CO 80222

Soil Conservation Society of
America
7515 N.E. Ankeny Road
Ankeny, IA 50021

Soil Science Society of America
677 South Segoe Road
Madison, WI 53711

Water Pollution Control Federation
3900 Wisconsin Avenue
Washington, DC 20016

Weed Science Society of America
Agronomy Department
University of Illinois
Urbana, IL 61801

Wilderness Society, The
729 15th Street, N.W.
Washington, DC 20005

Wildlife Management Institute
709 Wire Building
Washington, DC 20025

Wildlife Society, The
Suite S-176
3900 Wisconsin Avenue, N.W.
Washington, DC 20016

Zero Population Growth (ZPG)
367 State Street
Los Altos, CA 94022

BUSINESSES AND GOVERNMENTAL AGENCIES

IN NATURAL RESOURCES AND ENVIRONMENT

Action/Peace Corps
Jim Crowder
Recruiter
214 Pittsboro Street
Chapel Hill, NC 27514

Agriculture, Department of
Fourteenth St. & Independence Avenue, S.W.
Washington, DC 20250

Appalachian Regional Commission
1666 Connecticut Avenue
Washington, DC 20235

Commerce, Department of
Commerce Building
Fourteenth Street
Washington, DC 20230

Defense, Department of
The Pentagon
Washington, DC 20301

Dow Chemical Company
Building 9008
Midland, MI 43640

Doane Agricultural Service
8900 Manchester Road
St. Louis, MO 63144

Dupont
5727 East River Road
Chicago, IL 60631

Environmental Protection Agency
Waterside Mall
401 M Street, S.W.
Washington, DC 20460

Executive Office of the President
722 Jackson Place
Washington, DC 20006

Federal Chemical Company
646 Starks Building
Louisville, KY 40202

Farm Quarterly, The
222 East Central Parkway
Cincinnati, ON 45202

Health, Education, & Welfare, Department of
330 Independence Avenue, S.W.
Washington, DC 20201

Housing and Urban Development, Department of
HUD Building
451 Seventh Street, S.W.
Washington, DC 20410

Geigy
East Central Regional Office
8790 Purdue Road
Indianapolis, IN 46204

Interior, Department of
Interior Building
Washington, DC 20240

Justice, Department of
Constitution Avenue
Washington, DC 20530

Monsanto
J. P. Youngblood
Professional Recruiting Manager
800 North Lindbergh Boulevard
St. Louis, MO 63141

Natural Resources, Department of
Division of Forestry
Frankfort, KY 40601

Soil Conservation Service
333 Waller Avenue
Lexington, KY 40504

Southern States Cooperative
7th and Main Streets
P.O. Box 1656
Richmond, VA 23213

State, Department of
Special Secretary for
Environmental Affairs
2201 C Street
Washington, DC 20520

Tennessee Valley Authority
Knoxville, TN 32902

Tennessee Valley Authority
Land Between the Lakes
P.O. Box 27
Golden Pond, KY 42231

Thompson Hayward Chemicals
1585 Harber Avenue
Memphis, TN 38101

Transportation, Department of
Federal Highway Administration
400 Seventh Street, S.W.
Washington, DC 20490

Federal Aviation Administration
800 Independence Avenue, S.W.
Washington, DC 20591

U. S. Forest Service
27 Carol Road
Winchester, KY 40391

Water Resources Council
2120 L Street
Washington, DC 20037

# UNIT TWO

## DEFINITION OF THE CLUSTER AREA

## OF

## NATURAL RESOURCES AND ENVIRONMENT

UNIT PURPOSE: To define the cluster area of natural resources and environment.

PERFORMANCE OBJECTIVES: The student will be able to

I. Name the job families in the occupational cluster.

II. Describe how the cluster area serves the student and the economy.

I. The student will be able to name the two job families in the natural resources and environment occupational cluster.

Note: The student at this point is identifying the major job families without making an in-depth study.

A. Suggested Content

1. Major job families

a. Natural resources

b. Environment

2. Definition of each job family

a. Natural resources

(1) Natural resources includes a study of the following:

--Air
--Fish
--Land use planning
--Minerals and mineral fuels
--Range
--Recreation
--Soil
--Water
--Wildlife

(2) Range management is also often thought to include forestry which has been included in agribusiness and conservation in a very broad sense.

b. Environment

(1) Environment includes a study of the following:

--Air
--Chemicals, fertilizers, pesticides, radiation
--Health
--Land use
--Mineral resources
--Noise
--Parks and natural areas
--Soil
--Solid waste
--Water
--Wildlife

(2) In studying each of the above as they relate to the environment, some understanding of measurement, monitoring, quality and quantity are necessary. At least some of the social and economic factors which have an important impact on the environment need to be discussed.

3. Common job titles in each family

a. Natural resources

(1) Air

--Air monitoring technician
--Smoke tester
--Compliance section technician

(2) Fish

--Fish hatchery worker
--Fish farmer
--Frog farmer
--Alligator farmer
--Crab farmer
--Conservation patrolman
--Fish culturist
--Fish hatchery superintendent
--Fisheries scientist

(3) Land use planning

--Surveyor's assistant, rodman or chainman
--City planning aide
--Urban planning technician
--Zoning inspector
--Zoning technician
--Chief planner
--City planning engineer
--Urban planner
--Regional planner
--Land use planner
--Architectural engineer

(4) Minerals and mineral fuels

--Mining area restoration worker
--Open-pit mine conservation inspector
--Mining area restoration technician
--Scout
--Petroleum geologist
--Mineralogist
--Geologist

(5) Range

--Pest control worker
--Sprayer
--Range aide
--Range allotment official
--Range technician
--Range manager
--Range conservationist
--Range scientist

(6) Recreation

--Grounds keeper
--Park caretaker
--Park worker
--Recreation farm manager
--Dude-ranch manager
--Hunting and fishing guide
--Recreational development technician
--Fish and game club manager
--Winter sports manager
--Ski patrolman
--Waterways patrolman
--Park foreman
--Park naturalist
--Park superintendent

(7) Soil

--Surveyor's assistant, rodman or chainman
--Soil conservation aide
--Soil conservation technician
--Engineering technician (soil conservation)
--Soil scientist
--Agrogeologist (soil mapper; soil surveyor)
--Soil fertility expert
--Soil bacteriologist
--Soil conservationist
--Drainage design coordinator

(8) Water

--Irrigator
--Irrigator technician
--Watershed tender
--Drainage design coordinator
--Irrigation engineer
--Water resource investigator
--Hydrologist
--Well water inspector
--Oceanographer

(9) Wildlife

--Game farm worker
--Gamekeeper
--Animal shelter keeper
--Wildlife technician
--Game warden
--Game propagator
--Wildlife biologist

b. Environment

(1) Air

--Air pollution control worker
--Air monitoring technician
--Smoke tester
--Compliance section technician
--Engineering section technician
--Air pollution control supervisor
--Air pollution control meteorologist
--Air pollution control chemist
--Air pollution control engineer

(2) Chemicals: fertilizers, pesticides

--Spray applicator--ground or aerial
--Agricultural chemist
--Chemical technician
--Agricultural advisor
--Sprayer helper
--Sprayer foreman
--Field advisor

(3) Health

--Veterinarian's aide
--Veterinarian
--Sanitarians
--Livestock inspector
--Various animal and poultry specialists
--Laboratory technician--veterinary

(4) Land use

--City planning aide
--Urban planning technician
--Zoning inspector
--Zoning technician
--Chief planner
--City planning engineer
--Urban planner
--Regional planner
--Land use planner

(5) Mineral resources

--Mining area restoration worker
--Open-pit mine conservation inspector
--Mining area restoration technician
--Geologist
--Mineralogist
--Geophysicists

(6) Noise

--Acoustical engineers
--Agricultural engineers
--Mechanical engineers

(7) Parks and natural areas

--Grounds keeper
--Park caretaker
--Park worker
--Recreational development technician
--Waterways patrolman
--Park foreman
--Park naturalist
--Park superintendent

(8) Soil

--Surveyor's assistant
--Soil conservation aide
--Soil conservation technician
--Engineering technician
--Soil scientist
--Agrogeologist (soil mapper, soil surveyor)
--Soil fertility expert
--Soil bacteriologist
--Soil conservationist
--Drainage design engineer

(9) Solid waste

--Garbage collector
--Sanitary landfill manager
--Sanitary landfill assistant
--Incinerator operator
--Recycling plant manager

(10) Water

--Water filter cleaner
--Wastewater disposal worker
--Irrigator
--Irrigation technician
--Watershed tender
--Public health engineering aide
--Sanitarian aide
--Water and waste treatment plant operator
--Stream sanitation technician
--Oceanographic technician
--Ocean water pollution technician
--Oceanographic laboratory technician
--Drainage design coordinator
--Irrigation engineer
--Water quality chemist
--Geological oceanographer
--Public health bacteriologist

(11) Wildlife

--Game farm worker
--Gamekeeper
--Wildlife conservation officer
--Wildlife technician
--Game warden
--Game propagator
--Wildlife biologist

B. Suggested Teaching-Learning Activities

1. Involve the student in writing his present definition of natural resources and environment which would include the major job families as the student presently understands them, and then conduct an open class discussion.

2. Conduct a classroom discussion directed by the teacher concerning the different job families in natural resources and environment.

3. Use situational questions, depending on the locality from which the student originates (rural, urban, or inner-city), to relate natural resources and environment to the student.

   Examples of situational questions:

   Gasoline prices are much higher than they were in 1972. Why? How did the halting of construction of the Alaskan pipeline affect this situation? (The pipeline could help avoid future shortages.)

   This morning as you ate breakfast your mother had the dishwasher operating as well as the blender and several other appliances. Carpenters were nailing on a new garage. Two airplanes flew over rather low and an air hammer was being operated in the street. Why would this make you feel rather jumpy? (Noise has an effect on the nervous system and is also related to other health problems.)

   Last night you emptied all the wastebaskets in the house and they filled a 30 gallon garbage can. Where does this material go? (Most likely to a sanitary landfill. Discuss what a sanitary land fill is.)

4. Use discussion questions on pollution to stimulate student interest. Examples of discussion questions:

   Why are phosphates an important source of water pollution? (Phosphates are often the inhibiting factor for growth of algae and thus for entrophication to take place.)

   What is the largest source of phosphate pollution? (Municipal sewage.)

   What is entrophication? (It is the dying of lakes. Entrophication is a natural process but man is speeding it up.)

   Why is the internal combustion engine such a serious pollution problem? (First, because there are so many used and they are relatively inefficient using only 25 percent for fuel production. Secondly, the problems are difficult to overcome. A major problem is unburned hydrocarbons. Increasing the temperature at which the fuel is burned decreases the unburned hydrocarbons but causes more nitrogen dioxide to be formed. Nitrogen dioxide causes the brown haze seen around many cities today.)

Does one cow pollute as much as fifteen people? (The defecation from one large cow is approximately equal to the defecation of fifteen humans. However, a cow's defecation may be dropped on pasture or spread on land where it helps plants. Also, cows do not generally drink pop and leave cans, live in large houses, require large quantities of heating or air conditioning or many other luxuries people take for granted.)

Other areas that could be discussed:

Organic farming
DDT and other pesticides
Zoning
Population
Environmental Protection Agency (EPA)
Wilderness areas
Cluster concept in housing

4. A debate could be staged on use of nonreturnable bottles.

5. Discuss "Pickles Will Kill You," NRE-5, page 54, or type it up as a handout. Make sure that students see how correlations can be used to make things appear factual when they are not.

6. Show the transparency NRE-6, "Major Job Families in Natural Resources and Environment," page 55, and conduct discussions concerning the different areas in natural resources and environment.

7. Bring literature into the classroom or have the students research in the library or at home concerning the different areas in natural resources and environment.

   a. Examples of literature would be books which could be obtained from the agricultural teacher or school library or magazines.

   b. Students could bring from home various articles relating to natural resources and environment.

   c. A career corner could be developed just for displaying materials and articles concerning natural resources and environment.

8. Involve the student in playing the game, "What's My Job Family?" The game can be found on page 56.

9. Play the game of charades while role playing a particular job family or a particular job title within the family. The game can be found on page 57.

10. Play the game, "Match the Job Title to the Job Family." The game can be found on page 58.

11. Involve the student in developing a job family center. Develop a family card and a family area and collect materials such as pictures, etc., depicting the particular job family.

12. Involve the student in planning attractive bulletin board displays. They may want to divide according to job families and give a prize for the group that develops the best bulletin board display depicting their particular job family.

13. Present a slide or picture presentation of different types of natural resources and environment jobs.

C. Suggested Evaluation

Prepare a list of job families using examples in natural resources, environment and some in other occupational areas. The student will select those job families in natural resources and environment. Evaluate the student based on the number of correct matches made.

D. Suggested Resources

1. Resource persons

   a. Vocational agriculture teacher

   b. County extension agent

   c. Soil conservation agent

2. Books

   a. Experience Programs in Learning Vocations in Agriculture.

   b. Careers in Conservation: Opportunities in Natural Resources.

   c. Careers for the 70's: Conservation.

   d. Exploring Agriculture.

   e. Opportunities in Environmental Careers.

   f. Handbook of Agricultural Occupations.

   g. Your Future in Agriculture.

   h. Career Education in the Environment: A Handbook.

   i. Occupational Outlook Handbook.

3. Bulletins and Circulars

   a. "Should You Go Into Agriculture."

   b. "Choosing Agriculture for An Interesting Career."

4. Section B of the Guide

   a. Job Titles in Natural Resources and Environment, pp. 267-282.

   b. Content Outline of Job Families, pp. 283-298.

II. The student will be able to describe how the natural resources and environment cluster area serves the student and the economy.

A. Suggested Content

1. Changes in civilizations through history

a. Air

(1) Life cannot exist without reasonable quantities of quality air.

(2) Increased concentrations of population have led to polluted air surrounding most of our major cities.

3) Air pollution has been shown to increase the incidence and/or severity of many kinds of health problems.

b. Chemicals, fertilizers, pesticides, radiation

(1) Increasing quantities of chemicals, fertilizers, pesticides and radiation are being used.

(2) Side effects with various uses of the above have been observed.

(3) Interactions of various chemicals and long-term effects of many chemicals have not been fully determined.

c. Fish and wildlife

(1) Many species of fish and wildlife have been adversely affected by man-made changes in the environment.

(2) Demand for places to fish and hunt have increased with leisure time and population.

d. Health

(1) Better balanced meals and improvements in medical science have led to longer lives.

(2) Concentrations of people and increased pollution are associated with many health problems.

e. Land use

(1) Population continues to grow around areas that are already highly populated.

(2) Land is developed for parks, campsites, and outdoor activities.

(3) Construction projects such as highways and parking areas cover large areas with concrete and asphalt.

f. Minerals and mineral fuels

(1) The demand for minerals and mineral fuels continues to increase while the supply is being depleted.

(2) Better methods are being developed to locate minerals and mineral fuels and also to extract them from the ore.

g. Noise

(1) Increased technology such as jet planes, appliances around the home, power tools, and industrial machinery have added to the total din present in the world.

(2) As people are crowded into an area, their noises become louder and more obnoxious to others.

h. Soil

(1) Millions of tons of soil are lost from fields through wind and water erosion.

(2) Soil washed downstream becomes sediment which fills harbors and dams and may kill fish.

(3) The soil while being washed or blown may also damage a great deal of plant life.

i. Solid waste

(1) Increased population has led to use of more products and more solid waste.

(2) Elaborate packaging has increased the amount of solid waste accumulated.

j. Water

(1) Water pollution sources:

--Industries
--Municipalities
--Individuals
--Agriculture

(2) Results of water pollution includes damages to:

--Health
--Recreation
--Esthetics
--Fishing
--Agriculture
--Water supplies

2. The effects of natural resources and environment on the economy today.

a. Air

(1) Because of the air pollution found in many cities and some other areas, better--and in many cases expensive--control devices will be required by law.

(2) Natural forces such as volcanoes, forest fires, and wind storms cuase a good deal of air pollution.

(3) Air pollution damages human and animal health. It causes workers to be absent and contributes to many medical problems, which in turn account for large medical expenditures each year.

(4) Air pollution limits visibility, hides scenic beauty and dirties almost everything with which it comes in contact.

(5) Air pollution, in an uncontrolled manner, changes climatic conditions.

(6) Vegetation is damaged by dust particles and may be killed by chemicals carried with dust.

b. Chemicals, fertilizers, pesticides, radiation

(1) Because of the increased demand for food (meat in particular), more fertilizer and chemicals will likely be used to increase production.

(2) More research concerning long term effects of chemicals will be required.

(3) Better regulation of the application and use of chemicals will be required.

c. Fish and wildlife

(1) Fish and wildlife research and regulation will receive more funds because of the demands of sportsmen.

(2) Commercial fish and wildlife production are becoming more lucrative.

d. Health

(1) Causes, as well as cures, of cancer and other diseases indicate a need for more research.

(2) The importance of good health and good health care keep funding for most medical areas at high levels.

e. Land use

(1) Demand for land, and therefore the value of land, is increasing rapidly.

(2) Rapid land development has often led to less than desirable patterns of land use.

(3) Some developers have destroyed the esthetics of large areas.

(4) Cluster concept of housing has led to some open areas.

(5) Land capability is being studied and considered in land use.

f. Mineral resources

(1) The demand for mineral sources of fuel such as oil and gas is greater.

(2) The value of many metals is increasing.

g. Noise

(1) It takes very little energy to produce noise.

(2) Noise causes health problems and increases medical costs.

(3) Noise reduces efficiency and makes products cost more.

h. Parks and natural areas

(1) Parks and natural areas are in greater demand; therefore, the costs are generally going up.

(2) There is more demand for private parks and natural areas.

i. Soil

(1) The demand for food is increasing, thus increasing the demand for productive soil.

(2) Erosion-caused sediments represent the greatest volume of wastes entering surface waters.

j. Solid waste

(1) The cost of disposing of solid waste is increasing daily.

(2) Sanitary land fills are almost filled in many areas, and great difficulty and expense are encountered in locating new areas to use for sanitary land fills.

k. Water

(1) Sources of water pollution:

--Industries
--Municipalities
--Individuals
--Agriculture

(2) Results of water pollution:

--Damages to health
--Damages to recreation
--Damages to esthetics
--Damages to fishing
--Damages to agriculture
--Damages to water supplies
--Expensive control measures

(3) Demand for water of reasonable quality is increasing; therefore, the cost is also increasing.

1. Wildlife

(1) Demand for hunting and fishing has been increasing.

(2) Many people view wildlife populations as an important indicator of the condition of the total environment.

(3) Many of man's recent developments have had an adverse affect on wildlife.

B. Suggested Teaching-Learning Activities

1. Involve the student in a discussion of how natural resources and environment have been involved in changes in the American economy.

2. Have students prepare a short historical paper describing the developments in natural resources and environment.

3. Assist students in identifying the role of natural resources and environment in America and compare this to less affluent nations.

4. Involve the students in a self-analysis relating themselves to the world of natural resources and environment. Discuss the following or similar questions to help students perceive their role in natural resources and environment. (Some of these questions are slanted to encourage class participation. For example, zoning per se is not bad--there is good zoning and bad zoning. Please point this out in a discussion of question n.)

a. Why are phosphates an important source of water pollution?

b. What is the largest source of phosphate pollution?

c. What is "blue baby?" What causes it?

d. Why is the internal combustion engine such a serious pollution problem?

e. What is eutrophication?

f. Discuss important environmental problems caused by agriculture.

g. Discuss important environmental problems which adversely affect agriculture.

h. Is clear cutting in forestry a good environmental practice?

i. Is burning straw stubble an environmentally acceptable practice? Is burning refuse for grass seed production an environmentally acceptable practice?

j. Does one cow pollute as much as fifteen people? Explain.

k. Is organic farming the answer to agricultural pollution problems?

l. What is multiple use in forestry? Is this good environmentally speaking?

m. How bad is DDT?

n. How bad is zoning?

o. Is increasing population a serious problem?

p. What is a decibel? How is sound measured?

q. What is the EPA?

r. What is a wilderness area? Is it good or bad?

s. What is the cluster concept in housing?

t. Should nonreturnable bottles be outlawed?

5. Have students discuss how laws to improve or protect the environment would affect their family's economy. How might it affect the area in which they live.

6. Develop a natural resources and environment item center--the student can bring from home any items relating to natural resources and environment which are used or available. News items may also be used from magazines, books, etc. These items may be grouped according to job family.

7. Develop with the student a list of necessities required for survival and also a list of luxuries. Put these lists on the chalkboard and relate to natural resources and environment.

8. Make a list of natural resources and environmental businesses and discuss their function.

9. Bring to class various natural resources and environmental products and tell how the products are used and/or produced.

C. Suggested Evaluation

The student will write a short paper, "Why Natural Resources and Environment is Important to Me and My Economy." Evaluate the paper based on the number of reasons given for the importance of natural resources and environment.

D. Suggested Resources

1. Resource persons

   a. History teacher

   b. Soil Conservation Service personnel

   c. Forestry Service personnel

   d. Vocational agriculture teacher

   e. Cooperative Extension Service personnel

   f. Economics teacher

   g. Business people

   h. Local, state or federal environmental personnel

2. Books

   a. Experience Programs for Learning Vocations in Agriculture.

   b. Careers in Conservation: Opportunities in Natural Resources.

   c. Careers for the 70's: Conservation.

   d. Exploring Agriculture.

   e. Opportunities in Environmental Careers.

   f. Handbook of Agricultural Occupations.

   g. Your Future in Agriculture.

   h. Career Education in the Environment: A Handbook.

   i. Occupational Outlook Handbook.

# SUPPORTIVE MATERIALS FOR UNIT TWO

## REFERENCE LIST FOR UNIT TWO

### Books


1. Career Education in the Environment: A Handbook by the Olympus Research Corporation, Government Printing Office.

2. Careers for the 70's: Conservation by Ed Dodd, Crowell-Collier Press, 1971.

3. Careers in Conservation: Opportunities in Natural Resources by Henry Clepper, The Roland Press Company.

4. Experience Programs in Learning Vocations in Agriculture by Harold R. Binkley and Carsie Hammonds, The Interstate Printers and Publishers, Inc., 1970.

5. Exploring Agriculture by Everett F. Evans and Roy L. Donahue, Prentice-Hall, Inc.

6. Handbook of Agricultural Occupations by Norman K. Hoover, The Interstate Printers and Publishers, Inc.

7. Occupational Outlook Handbook by The United Stated Department of Labor, Government Printing Office.

8. Opportunities in Environmental Careers by Odom Fanning, National Foundation for Environmental Control.

9. Your Future In Agriculture by Chester S. Hutchinson, Richards Rosen Press, Inc.


### Bulletins and Circulars


1. "Choosing Agriculture for an Interesting Career," Professional Personnel Recruitment, American Vocational Association, 1510 H Street, N.W., Washington, DC 20005.

2. "Should You Go Into Agriculture," Career Information Service, New York Life Insurance Company, Box 51, New York, NY 10010.


*Addresses of publishers can be found in the Appendix.

# PICKLES WILL KILL YOU!

Every pickle you eat brings you nearer to death!

Amazingly, most thinking people have failed to grasp the terrifying significance of the term, "in a pickle."

Pickles are associated with all major diseases of the body. Eating them breeds wars and communism. They can be related to most airline tragedies. Auto accidents are caused by pickles. There exists a positive relationship between crime waves and the consumption of this fruit of the cucurbit family. For example, recent surveys have shown:

1. Nearly all sick people have eaten pickles. The effects are obviously cumulative.

2. Of all people who died from cancer, 99.9 percent have eaten pickles.

3. Pickles are associated with pregnancy. Nearly all pregnant women crave this bitter fruit.

4. Ninety-eight and six tenths percent of all Russian sympathizers have eaten pickles.

5. Furthermore, 99.7 percent of the people involved in air and automobile accidents consumed pickles within 14 days preceding the crashes.

6. A total of 93.1 percent of juvenile delinquents come from homes where pickles are served frequently.

Perhaps you need evidence of a long-term nature. If so, consider these facts:

1. Of the people born in the year 1839 who later dined on this vegetable, there has been a 100 percent mortality!

2. All pickle eaters born between 1849 and 1859 have (1) wrinkled skin; (2) lost most of their teeth; (3) brittle bones, and (4) failing eyesight--if the ills of eating pickles have not already caused their deaths.

I'm not AGAINST pickles--JUST THE EATING OF PICKLES!!

In spite of all these ills, the money-hungry pickle growers and pickle packers spread their evil. More than 120,000 acres of fertile U. S. soil are now devoted to the production of the evil cucumber, and our per capita consumption is nearly four pounds per year.

# MAJOR JOB FAMILIES IN NATURAL RESOURCES AND ENVIRONMENT

1. Air
2. Chemicals and Radiation
3. Fish
4. Health
5. Land Use
6. Minerals and Mineral Fuels
7. Noise
8. Parks and Natural Areas
9. Range
10. Recreation
11. Soil
12. Solid Waste
13. Water
14. Wildlife

## WHAT'S MY JOB FAMILY?

Directions:

You may want to divide the class into groups for competition concerning the identification of the correct job family. Prizes may be given to the winning team. Present each team with a list of the six different job families either by showing a transparency of the different job families, making job family cards, or just writing the job families on the board.

Then refer to the occupational briefs found on pages 149-265 in the guide and select different briefs relating to each job family area. Pick out certain key characteristics of each job and read the characteristics to the teams. The first team who identifies the job family into which each job fits wins. You can also use the content outline of the different job families, found on pages 283-298 in the guide, to select characteristics to be used in the contest.

A similar contest entitled "What's My Job Title" could also be used following the same principle. The list of job titles found on pages 267-282 in the guide could be used.

## CHARADES

Charades is a game in which all the students or groups of students could become involved in play acting or role playing different job families or job titles.

Begin by assigning a student or a group of students a particular job family or job within the family. Then supply the student with the occupational brief or the sources of information concerning the job or job family which he is going to role play. Involve each student or groups of students in developing his own strategy for role playing the particular job or job family.

Have each student role play before the class and have the class try to guess the job family or job title the student is depicting. Prizes may be given to the best actor and also the student who identifies the most roles.

## MATCH THE JOB TITLE TO THE JOB FAMILY

Directions: This game may be played in different ways. Included below are some suggested alternatives.

Suggestion 1

Assign each student with five job titles and have him individually, through research, determine the correct job family for each job title.

Suggestion 2

Give each student or group of students a list of the different job families. Then you as a teacher read a certain job title. Have the student who knows the answer stand, give his answer and his reasons for choosing that answer.

Suggestion 3

Prepare a handout listing different job titles and job families. Have the student match the job title to the job family in natural resources and environment.

UNIT THREE

EXPLORATION OF THE

NATURAL RESOURCES AND ENVIRONMENT CLUSTER

UNIT PURPOSE: To explore the natural resources and environment cluster.

PERFORMANCE OBJECTIVES: The student will be able to

I. Present an overview of the total natural resources and environment cluster.

II. Describe in depth at least two natural resources and environment jobs.

III. Participate in hands-on activities which relate to the natural resources and environment cluster.

I. The student will be able to present an overview of the total natural resources and environment cluster.

Note: The purpose of this objective is not to study specific jobs but to get an overview of the natural resources and environment cluster.

A. Suggested Content

1. Information to secure

a. Location of the business or area visited or studied

b. Name of the business or person visited or studied

c. Job family observed

d. Primary function

e. Major activities being conducted

f. Competencies required for success in the general job family

g. General overview of the job family observed

(1) Working conditions
(2) Items working with
(3) Major tasks performed

2. Selected means of securing information

a. Field trips

b. Literature

c. Films and other audio-visual aids

d. Resource people

B. Suggested Teaching-Learning Activities

1. Form career exploration clubs or committees hinging around major job families in natural resources and environment.

a. Club examples

(1) Natural Resources Club
(2) Environmental Club
(3) Students for a Better Environment
(4) Conservation Club
(5) Wildlife Club
(6) Forestry Club
(7) Soil and Water Conservation Club

b. Clubs may want to elect officers and hold meetings.

c. Club members may be selected based on student preference or randomly assigned by the teacher.

2. The teacher should hold each club responsible for using the list of resources developed upon completion of Objective V in Unit One for exploring their particular job family area.

   a. Example--Wildlife Club explores the job family of wildlife.

   b. Example--Soil and Water Conservation Club explores the job family of land use.

   c. Example--Natural Resources Club could divide up to work on almost any area.

3. Teacher should aid each club in locating materials, setting up field trips, identifying films, etc.

4. Clubs should select field trips that relate to their particular family. Suggested visitation areas for each job family:

   a. Air

      (1) Foundry
      (2) State Air Pollution Control Laboratory
      (3) Automobile dealer
      (4) Forestry slash burning operation

   b. Chemicals and radiation

      (1) Chemical dealer
      (2) Chemical producer
      (3) Fertilizer plant
      (4) Test plots
      (5) Livestock or poultry operation

   c. Fish

      (1) Fish farm
      (2) Fish hatchery
      (3) Fish and game department

   d. Health

      (1) City or State Health Department
      (2) Veterinarian
      (3) Hospital

e. Land use

(1) Apartment complex
(2) Traditional housing complex
(3) Cluster concept housing complex
(4) Recreation or second home development
(5) Agricultural land
(6) Area in multiple use

f. Minerals and mineral fuels

(1) Strip mine
(2) Shaft mine
(3) Oil field
(4) Oil refinery

g. Noise

(1) Police station
(2) Industry working on noise problem
(3) Hearing clinic

h. Parks and natural areas

(1) City park
(2) State park
(3) National park
(4) Natural area

i. Range

(1) Pasture
(2) Forested area where grazing takes place

j. Recreation

(1) Lake
(2) Playground
(3) City recreation department
(4) Recreation farm

k. Soil

(1) Sod waterway
(2) Cover crop
(3) Strip cropping
(4) Drainage project
(5) Soil Conservation Service (SCS) office

l. Solid waste

(1) Sanitary landfill
(2) Dump
(3) Incinerator
(4) Recycling operation
(5) Paper shredder

m. Water

(1) Waste water treatment plant
(2) Water treatment plant (where chlorine is added)
(3) City or state water monitoring facility
(4) Lake, river, or stream

n. Wildlife

(1) Wildlife sanctuary
(2) Game hatchery
(3) Game farm
(4) Game warden's office

5. Club members should have exploration form while on the field trip to record observed information. A sample exploration form is on page 103.

Note: Teacher may want to practice with the student filling out the form before the actual trip.

6. Teacher, in close cooperation with club members, should plan every detail of the trip. If it is decided upon and can be arranged, different clubs may take different trips. Additional help from parents or teacher aides may be required.

7. Club members can collect exploration information in the following ways:

a. Fill out exploration form.

b. Take pictures.

c. Carry a tape recorder or cassette and record happenings.

d. Collect materials, brochures, and leaflets.

8. Each club should share exploration experiences with other class members.

a. Teacher may want to designate certain days as club days.

b. Clubs may share exploration experiences in the following ways:

(1) Develop a club exploration center.
(2) Give oral or written class reports.
(3) Show photographs or slides taken.
(4) Show or display the literature collected.
(5) Conduct club discussions.
(6) Form club panels for question and answer sessions.

9. Teachers can also direct clubs in securing exploration information from books, films, or other means. An exploration form should also be used. An example of an audio-visual exploration report can be found on page 104.

Note: The teacher may make the decision that the class should not be divided into clubs or committees, but will choose to explore all the job families with all the class members. This will depend on time and teacher preference. The teaching-learning activities suggested can also be applied if exploring all the job families as a total group.

C. Suggested Evaluation

The student will present to the class, in the form of an oral report, the information secured concerning the job family explored. Evaluate the report based on the amount of information obtained.

D. Suggested Resources

Note: The resources will be broken down according to job family area.

1. Resource persons

a. Air

(1) Air pollution control worker
(2) Air monitoring technician
(3) Smoke tester
(4) Compliance section technician
(5) Engineering section technician
(6) Air pollution control supervisor
(7) Air pollution control meteorologist
(8) Air pollution control chemist
(9) Air pollution control engineer

b. Chemicals

(1) Pesticide applicator (farmer or commercial)
(2) Chemical salesman
(3) Chemist
(4) Chemical lab technician
(5) Laboratory technician
(6) Cooperative extension agent

c. Fish

(1) Fisherman
(2) Fish farmer
(3) Fish hatchery worker
(4) Conservation patrolman
(5) Fish culturist
(6) Fish hatchery superintendent
(7) Fisheries scientist

d. Health

(1) M. D. (Doctor of Medicine)
(2) O. D. (Doctor of Optometry)
(3) R. N. (Registered Nurse)
(4) L. P. N. (Licensed Practical Nurse)
(5) Health department official

e. Land use

(1) Surveyor or assistant
(2) City planning aide
(3) Urban planning technician
(4) Zoning inspector
(5) Zoning technician
(6) Chief planner
(7) City planning engineer
(8) Urban planner
(9) Regional planner
(10) Land use planner
(11) Architectural engineer

f. Minerals and mineral fuels

(1) Mining area restoration worker
(2) Open-pit mine conservation inspector
(3) Mining area restoration technician
(4) Scout
(5) Petroleum geologist
(6) Mineralogist
(7) Geologist

g. Noise

(1) Police officer
(2) Mechanical engineer
(3) Acoustical engineer
(4) Governmental official who works with noise problems

h. Parks and natural areas

(1) Park worker
(2) Park ranger
(3) Park superintendent
(4) Naturalist

i. Range

(1) Pest control worker
(2) Range manager
(3) Range conservationist
(4) Range scientist
(5) Farmer

j. Recreation

(1) Physical education teacher
(2) Representative from city recreation office
(3) Recreation farm worker
(4) Recreation farm manager
(5) Waterways patrolman

k. Soil

(1) Surveyor or assistant
(2) Soil conservation aide or technician
(3) Soil scientist
(4) Soil conservationist
(5) Drainage design coordinator

l. Solid waste

(1) Manager of sanitary landfill
(2) Worker at sanitary landfill
(3) Incinerator operator

m. Water

(1) Water filter cleaner
(2) Public health engineering aide
(3) Sanitarian or aide
(4) Water and waste treatment plant operator
(5) Water quality chemist

n. *Wildlife*

(1) Game farm worker or manager
(2) Gamekeeper
(3) Animal shelter keeper
(4) Wildlife technician
(5) Game warden
(6) Game propagator
(7) Wildlife biologist

2. Books

a. See pages 92-102 for complete reference list for Unit Three.

3. Films and Filmstrips

a. See pages 92-102 for complete reference list for Unit Three.

II. The student will be able to describe in depth at least two natural resources and environment jobs.

A. Suggested Content

1. Method of in-depth study

a. Interview

b. Observation

c. Resource people in classroom

d. Media

e. Literature

2. Information to secure

a. Specific job title name

b. Employment outlook

(1) Present
(2) Future

c. Nature of the work

(1) Duties performed
(2) Advantages of the job
(3) Disadvantages of the job
(4) Working conditions

--Salary
--Hours
--Fringe benefits

d. Personal qualities required

(1) Interests
(2) Physical abilities
(3) Mental abilities

e. Qualifications for employment

(1) Formal education
(2) On-the-job training
(3) Previous work experience

B. Suggested Teaching-Learning Activities

1. The teacher should aid the student in narrowing down his interest to a particular job family or job families, then to specific job titles within the family.

   Note: Previous learning should provide the base for the student to narrow his choice down to a particular job title within a job family. This is not to say that the student has finalized his career choice.

2. The teacher should hold each student responsible for exploring in depth and securing information, as outlined under content, for at least two jobs.

3. The teacher should aid each student in planning his strategy for the in-depth study. Assistance should be given in setting up interviews, locating resource people, or securing media.

4. The resource file developed by the student in Objective V, Unit One should provide an excellent base from which to secure exploratory ideas.

5. Student, with aid from teacher, should develop a form for recording information while interviewing, observing, or studying the literature. A sample form can be found on pages 105-106.

6. Information can also be collected as outlined in Activity 7 of the previous objective, page 64.

7. The teacher should have each student report orally to the class concerning the specific jobs observed. Time should be allowed for questions and discussions.

8. The teacher can aid the student in choosing from the following resource people as identified in the resource file.

   a. Natural resources

      (1) Air

         --Air monitoring technician
         --Smoke tester
         --Compliance section technician

(2) Fish

--Fish hatchery worker
--Fish farmer
--Frog farmer
--Alligator farmer
--Crab farmer
--Conservation patrolman
--Fish culturist
--Fish hatchery superintendent
--Fisheries scientist

(3) Land use

--Surveyor's assistant, rodman or chainman
--City planning aide
--Urban planning technician
--Zoning inspector
--Zoning technician
--Chief planner
--City planning engineer
--Urban planner
--Regional planner
--Land use planner
--Architectural engineer

(4) Minerals and mineral fuels

--Mining area restoration worker
--Open pit mine conservation inspector
--Mining area restoration technician
--Scout
--Petroleum geologist
--Mineralogist
--Geologist

(5) Range

--Pest control worker
--Sprayer
--Range aide
--Range allotment official
--Range technician
--Range manager
--Range conservationist
--Range scientist

(6) Recreation

--Grounds keeper
--Park caretaker
--Park worker
--Recreation farm manager
--Dude ranch manager
--Hunting and fishing guide
--Recreational development technician
--Fish and game club manager
--Winter sports manager
--Ski patrolman
--Waterways patrolman
--Park foreman
--Park naturalist
--Park superintendent

(7) Soil

--Surveyor's assistant, rodman or chainman
--Soil conservation aide
--Soil conservation technician
--Engineering technician (soil conservation)
--Soil scientist
--Agrogeologist (soil mapper; soil surveyor)
--Soil fertility expert
--Soil bacteriologist
--Soil conservationist
--Drainage design coordinator

(8) Water

--Irrigator
--Irrigation technician
--Watershed tender
--Drainage design coordinator
--Irrigation engineer
--Water resource investigator
--Hydrologist
--Well water inspector
--Oceanographer

(9) Wildlife

--Game farm worker
--Gamekeeper
--Animal shelter keeper
--Wildlife technician
--Game warden
--Game propagator
--Wildlife biologist

b. Environment

(1) Air

--Air pollution control worker
--Air monitoring technician
--Smoke tester
--Compliance section technician
--Engineering section technician
--Air pollution control supervisor
--Air pollution control meteorologist
--Air pollution control chemist
--Air pollution control engineer

(2) Chemicals and radiation

--Spray applicator--ground or aerial
--Agricultural chemist
--Chemical technician
--Agricultural advisor
--Sprayer helper
--Spray foreman
--Field advisor

(3) Health

--Veterinarian's aide
--Veterinarian
--Sanitarian
--Livestock inspector
--Various animal and poultry specialists
--Laboratory technician--veterinary

(4) Land use

--City planning aide
--Urban planning technician
--Zoning inspector
--Zoning technician
--Chief planner
--City planning engineer
--Urban planner
--Regional planner
--Land use planner

(5) Mineral resources

--Mining area restoration worker
--Open-pit mine conservation inspector
--Mining area restoration technician
--Geologist
--Mineralogist
--Geophysicist

(6) Noise

--Acoustical engineers
--Agricultural engineers
--Mechanical engineers
--Physicists
--Biomedical engineers
--Industrial engineers
--Audiologists

(7) Parks and natural areas

--Grounds keeper
--Park caretaker
--Park worker
--Recreational development technician
--Waterways patrolman
--Park foreman
--Park naturalist
--Park superintendent

(8) Soil

--Surveyor's assistant, rodman or chainman
--Soil conservation aide
--Soil conservation technician
--Engineering technician
--Soil scientist
--Agrogeologist (soil mapper; soil surveyor)
--Soil fertility expert
--Soil bacteriologist
--Soil conservationist
--Drainage design engineer

(9) Solid waste

--Garbage collector
--Sanitary landfill manager
--Sanitary landfill assistant
--Incinerator operator
--Recycling plant manager
--Waste treatment operators
--Waste disposal men

(10) Water

--Water filter cleaner
--Waste water disposal worker
--Irrigator
--Irrigation technician
--Watershed tender
--Public health engineering aide
--Sanitarian aide
--Water and waste treatment plant operator
--Stream sanitation technician
--Oceanographic technician
--Ocean water pollution technician
--Oceanographic laboratory technician
--Drainage design coordinator
--Irrigation engineer
--Water quality chemist
--Geological oceanographer
--Public health bacteriologist

Note: The teacher may make the decision that individual in-depth exploration is not feasible due to lack of time and teacher preference. In-depth study can be conducted in groups or even as a total class.

9. Involve the student in studying occupational briefs as found in the guide, on pages 149-265, or presented in the reference material.

10. Involve the student in an in-depth investigation of literature and media concerning various jobs.

C. Suggested Evaluation

The student will develop a notebook or folder containing information which he has collected or developed related to the jobs explored in depth. Evaluate the folder or notebook based on the adequacy of development.

D. Suggested Resources

Note: The resources as outlined under the previous objective can be adapted to the in-depth study of specific jobs in natural resources and environment.

1. Bulletins and Circulars

a. "A Career for You in Wildlife Conservation."

b. "Agriopportunities."

c. "An Engineering Career for You in the Soil Conservation Service."

d. "Careers in Landscape Architecture."

e. "Careers in Soil Conservation Service."

f. "Students--Start Your Career in SCS Before You Graduate."

3. Films

a. "Dynamic Careers Through Agriculture."

4. Appendix of the Guide

a. Occupational Briefs found on pages 149-265.

III. The student will be able to participate in hands-on activities which relate to the natural resources and environment cluster.

A. Suggested Content

1. Activities relating to air

   a. Comparing air pollution from a tuned and untuned automobile

   b. Observing oxygen production from green plants

2. Activities relating to chemicals, fertilizers, pesticides, radiation

   a. Demonstration of value of fertilizer

   b. Demonstration of effects of 2-4 D on dandelions

3. Activities relating to health

   a. Testing the environment for bacteria

   b. Effect of mouthwashes on bacterial growth

4. Activities relating to land use

   a. Planning a small area

   b. Coloring a soil type map

5. Activities relating to mineral resources

   a. Testing hardness of minerals

   b. Identifying minerals

6. Activities relating to noise

   a. Using sound-level meter to determine noise levels

   b. Experimenting with sound reduction

7. Activities relating to parks and natural areas

   a. Planting a tree

   b. Building and lighting a campfire

8. Activities relating to soils

   a. Taking a soil sample

   b. Separating various soil textures

9. Activities relating to solid waste

   a. Estimating waste for one year in your town or city

   b. Picking up litter from one-fourth mile of roadside

10. Activities relating to water

   a. Measuring water from a leaky faucet

   b. Checking sediment in water from various sources

11. Activities relating to wildlife

   a. Enticing one or more species of wildlife to live near the school by improving habitat

   b. Observing how birds help to destroy insects

B. Suggested Teaching-Learning Activities

1. Involve the student in activities relating to air.

   a. Comparing air pollution from a tuned and untuned automobile

      (1) Take a field trip to a place where automobiles are tuned. Collect a sample of air from an untuned automobile. After it has been tuned take a second sample.

      (2) Take air samples to a laboratory for analysis.

      (3) Discuss the results of the tests and the importance of keeping automobile engines tuned in light of the large number of automobiles operated each day.

   b. Observing oxygen production from green plants

      (1) Take two equal sized airtight containers. Leave one empty or add soil only. In a second one put in several green plants.

(2) After both containers have been exposed to sunlight or artificial light used for plant production for a few days, measure the oxygen in each container.

(3) Involve students in calculating the amount of oxygen produced. Discuss the amount of oxygen given off by one acre of forest in a year.

(4) If test equipment is not available, use a glowing splinter to show that oxygen has been produced in the container with the plants. Splinter should burst into flame in oxygen.

(5) Discuss photosynthesis and how important plants are in providing oxygen.

c. Involving the student in other activities relating to air

(1) Identify various air pollutants.

(2) Determine the effect of heat on air volume.

(3) Demonstrate propulsion by using a balloon.

2. Involve the student in activities relating to chemicals, fertilizers, pesticides, radiation.

a. Demonstration of value of fertilizer

(1) Using pots filled with sterile soil, grow plants; add various fertilizers to some pots.

(2) Observe differences in pots. Examine and explain any symptoms of nutrient deficiencies that plants show.

(3) Calculate the cost of fertilizer per acre for two common crops at average rates of application.

(4) Weigh plants produced in sterile pots and describe results of various fertilizers.

b. Demonstration of effects of 2-4 D on dandelions

(1) Find an area on or near school grounds which has a number of dandelions or other broadleaf weeds in a lawn. After obtaining permission to use 2-4 D on an area, stake out the demonstration area.

(2) Apply 2-4 D to the demonstration area, being sure to follow the instructions carefully and, better still, reading them to the students.

(3) Observe the demonstration area and discuss the results.

c. Involving students in other activities relating to chemicals, fertilizers, pesticides, radiation

(1) Measure radiation of selected items.

(2) Spray to control insects.

(3) Calibrate a sprayer.

3. Involve the student in activities relating to health.

a. Testing the environment for bacteria

(1) Obtain petri dishes with agar which have been heated in an autoclave or pressure cooker.

(2) Use a wax marking pencil to draw two perpendicular lines on the outside bottom of each of two petri dishes. This will divide them into quarters.

(3) Number each quarter so that you have them marked 1-8.

(4) Holding the petri dish upside down, inoculate the quarters as follows: (use a flamed loop for liquid)

--A drop of tap water
--A drop of pond water
--Touch with edge of a coin
--Do not inoculate
--Touch with used end of a lipstick
--Scrapings from between teeth
--A drop of fresh milk
--Do not inoculate

(5) Place the three inoculated petri dishes back in the incubator for 18-24 hours. Be sure to stack them with the smaller dish containing the agar resting on top of the larger empty dish.

(6) Remove and examine the dishes for bacterial growth.

Caution: Be sure not to open the dishes--some of the living bacteria may be pathogenic (cause disease).

b. Effect of mouthwashes on bacterial growth

(1) Using two petri dishes, one which has been spread with .3 ml of Staphylococcus aureus and one which has been spread with .3 ml of Escherichia coli, divide them into quarters by marking them with a wax pencil on the bottom.

(2) Add a drop of three different mouthwash materials to quarters 1, 2, and 3. Leave quarter 4 as a control.

(3) Observe for three or four days and determine which mouthwash is most effective for each bacteria.

(4) Determine some other materials that can be used to control bacteria.

c. Involving the students in other activities relating to health

(1) Determine why bread rises.

(2) Examine results of studies showing the effect of the environment on health.

(3) Demonstrate effective methods of sterilizing equipment.

4. Involve the student in activities relating to land use.

a. Planning a small area

(1) Give each student a map of a small area and a description of the area. Visit the area if possible.

(2) Have student develop a land use plan for the area.

(3) Discuss the area with a planner.

b. Coloring a soil type map

(1) Give each student a map on which soil types are designated.

(2) Give student a legend showing correct color for each soil type.

(3) Have student color map.

(4) Look at some professionally done soil type maps.

(5) Discuss value and use of soil type maps.

c. Involving the students in other activities relating to land use

(1) Determine how much land has been removed from the tax rolls in the last years.

(2) Learn to identify all light land classes.

(3) Role play activities that might take place at a planning meeting.

5. Involve the student in activities relating to mineral resources.

a. Testing hardness of minerals

(1) Give students several specimens of common minerals.

(2) Introduce students to Mohs' Scale of hardness and give them a sample of those available.

Mohs' Scale

| | |
|---|---|
| 1. talc | 6. orthoclase |
| 2. gypsum | 7. quartz |
| 3. calcite | 8. topaz |
| 4. fluorite | 9. corundum |
| 5. apatite | 10. diamond |

(3) Testing hardness consists of finding which materials the unknown specimen can and cannot scratch. For example, fluorite scratches calcite but not apatite. Any mineral that scratches calcite but not fluorite has a hardness of between 3 and 4 on Mohs' Scale. Other standards of hardness include: fingernail 2.5, penny 3.0, glass or knife blade 5.5, steel file 6.5.

b. Identifying minerals

(1) Have students bring to class rocks and minerals they have found.

(2) Determine which specimens brought in are minerals and which are rocks. A good earth science book will help identify properties for which to look.

(3) Identify as many of the rocks and minerals as possible. A science teacher may be able to help in identifying some of the more difficult ones.

(4) Make a display of a number of the specimens that were collected.

c. Involving students in other activities relating to mineral resources

(1) Check specific gravity of selected minerals.

(2) Identify the six basic crystal forms.

(3) Make streaks with selected minerals on streak plate.

6. Involve the student in activities relating to noise.

a. Using sound-level meter to determine noise levels

(1) If possible, obtain a sound-level meter for use with class. If this is not possible, get someone such as a policeman to come demonstrate the sound-level meter and make some sample readings. (Sound-level meter should read decibels in A scale giving dB-A.)

(2) Using the sound-level meter, have students record dB-A levels around the school and in other environments in which they live and work.

(3) Have students make note of things which seem to affect noise level such as carpet, drapes, certain ceilings, plants, baffles and shapes of rooms.

b. Experiments to reduce sound

(1) Obtain various materials which can be used near a constant sound source, such as a phonograph, to determine their ability to dampen sound.

(2) Using the sound-level meter, check the dB-A with various materials surrounding a constant source of sound. Also try to determine whether noise levels vary from room to room, and if so, why?

(3) Record results of experimentation and display them where other class members can see them.

c. Involving students in other activities related to noise

(1) Determine what happens to total decibels when two equal sources of noise are put side by side.

(2) Have students try on noise reducing earmuffs.

(3) Have students work to reduce noise around the school.

7. Involve the studerts in activities relating to parks and natural areas.

   a. Planting a tree

      (1) Dig hole for tree large enough for the roots and plenty of good soil.

      (2) Partly fill hole with good soil so top of root ball will be even with soil surface.

      (3) Where drainage is poor, plant trees on the "high side" by building up the area around the root ball with good soil.

      (4) Drive supporting stakes firmly into the soil next to the root ball.

      (5) Finish filling hole with good soil, tamping it firmly. Ridge the soil so it forms saucer-like basin.

      (6) Tie tree to the supporting stakes with hose-covered wire. Water well to settle soil.

      (7) Wrap trunk downward with burlap strip, tying wrap every 18 inches with stout cord.

   b. Building and lighting a campfire.

      (1) At least a 10-foot circle should be cleared down to mineral soil or rock. Placing rock in a circle around the area where burning is to take place adds additional safety.

      (2) Gather at least a hat full of tinder. Tinder is dry dead twigs, dry cedar bark, birchbark evenly damp. Dry pine needles, leaves, grass and such materials will also work as tinder.

      (3) Gather at least a hat full of kindling which is pencil sized dead twigs.

      (4) Gather fuelwood which ranges from the size of your finger to about 8-10" diameter logs.

      (5) Pile tinder in small pile. Then crisscross smallest, driest kindling over the tinder. Then with back to wind, light the tinder.

      (6) Add the rest of the kindling as fire increases, and then as fire is roaring, add fuelwood to it as needed.

c. Involving students in other activities related to parks and natural areas

(1) Pack a back pack that would have all needed materials for a three day trip into a wilderness area.

(2) Set up a two-man tent and dig a trench around it.

(3) Use a compass and map to get from point A to point B.

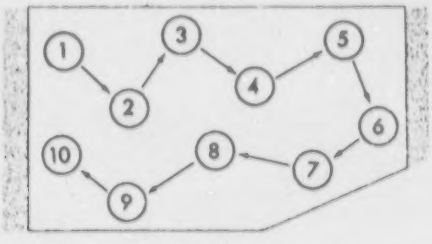
8. Involve the students in activities relating to soil.

a. Taking a soil sample

(1) Use clean sampling tools such as a tube, spade, or auger to take the sample. A clean pail is fine for collecting and mixing samples.

(2) Separate samples should be taken for different treatments and soil types.

(3) The diagram below shows how to take a composite sample from a field when only 10 samplings are made.




This diagram shows how to take a composite sample from a field when only 10 samplings are made.

(4) Take sample to plow layer depth--6 to 8 inches. When using a spade, make a one inch slice, then trim until it is one inch wide in the center.

(5) Crush lumps, mix soil well and spread it evenly over clean paper; air dry.

(6) Place 1/2 to 1 pint of soil in a clean container; label it as to sample and field name or number, and take it to your county agricultural extension office.

b. Separating various soil textures

(1) Take a brace and bit or shovel and remove some soil from your lawn or field. Get the soil from the top to bottom to a depth of 6 to 10 inches.

(2) Put this soil in a bucket or pan and let it dry.

(3) Mix the soil well.

(4) Place about a pint of the soil in a quart jar.

(5) Fill the jar with water and put on the lid.

(6) Shake the jar until the soil and water are well mixed.

(7) Put the jar out of the way for 2 or 3 hours.

(8) Now examine the soil.

(9) Notice that course sand is on the bottom, fine sand is next, silt is next and the clay is on the top.

(10) Determine which layer is the largest.

(11) Empty the water out carefully, and feel the difference in each layer.

c. Involving the students in other activities relating to soils

(1) Use Abney level or homemade slope board to measure slope of several areas.

(2) Construct a soil profile and label the various horizons. (Soil Conservation Service personnel can help with many such projects.)

(3) Learn to identify soil textures by feel.

9. Involve the students in activities relating to solid waste.

a. Estimating waste for one year in your town or city

(1) Keep a record of the waste that your family puts into garbage cans for a two week period.

(2) Divide by 14 the number of gallons you recorded in number one to get the average daily amount. Divide this by the number of persons in your family to get the average waste per day per person.

(3) When you multiply the average per day per person by the number of people in your town and that by 365 to get the amount you get for a year, the problem becomes obvious.

(4) Visit a sanitary landfill. Check how long it has operated and estimate how much longer it can operate.

b. Picking up litter from one-fourth mile of roadside

(1) Select a section of roadway one-fourth mile in length which should produce a goodly amount of litter.

(2) Arrange for bags, boxes or other containers in which to place litter. Have trucks or other vehicles available in which to place the litter.

(3) Develop a system to measure the litter either by weight or volume. If possible, take litter to be recycled, or take it to a proper disposal area.

(4) Discuss the costs and man hours involved in picking up litter.

c. Involve students in other activities relating to solid waste.

(1) Determine the number of active sanitary landfill sites in your county.

(2) Determine the number of incinerators in the nearest city or town.

(3) Visit a recycling unit and determine how much of various materials are being recycled.

10. Involve the students in activities relating to water.

a. Measuring water from a leaky faucet

(1) If a leaky faucet is available, use it. If a leaky faucet is not available, simulate the problem by running a faucet about like a leaky faucet would operate.

(2) Place a bucket or other container under the faucet for an hour. Measure the amount of water lost. Multiply by 24 to get the amount lost each day until the faucet is repaired.

(3) Estimate the loss of water from leaky faucets in your town last year.

(4) Discuss the fact that some major cities like New York have had seasonal water shortages.

b. Checking sediment in water from various sources

(1) Obtain three tall narrow bottles, such as olive bottles.

(2) After a heavy rain, fill one bottle from a stream that gets a good part of its water from cultivated fields.

(3) Fill a second bottle with water from a stream that receives most of its water from woodland.

(4) Fill the third bottle with water from a stream that receives most of its water from good pasture or meadow.

(5) Allow all three of the samples to settle for a few days. Look at them daily and make notes on what you see.

(6) Discuss the damage caused by sediment which results in loss of good land, filling in harbors and dams, killing fish, and lowering water quality.

c. Involving students in other activities relating to water

(1) Measure pollution in local streams.

(2) Determine water used in one home for one week or month.

(3) Do experiments on the amount of chlorine needed to kill various microorganisms.

11. Involve students in activities relating to wildlife.

a. Enticing one or more species of wildlife to live near the school by improving habitat

(1) Study the types of birds or animals that could reasonably be attracted to the area or school.

(2) Build the correct type of bird house, shelter or pile of brush; plant food and other cover to suit the type of species desired. If a pond or other source of water is available, this will increase the possible species.

(3) Observe how beneficial changes in habitat increase numbers of wildlife.

b. Observing how birds help to destroy insects

(1) Locate a nearby robin's nest. Then find a spot where you can watch it without disturbing the robins.

(2) After you are sure the eggs have hatched, watch the next for an hour at the same time each day and count the number of trips the parent birds make to the nest. Do this for several days and average the number of trips they make in an hour.

(3) You can be fairly sure that on each trip they make the birds are carrying at least one insect of some kind. Actually, they may be carrying several.

(4) After you have made the count for several days and have averaged the number of trips they make per hour, multiply this figure by the number of hours of daylight. This will give you an estimate of the total number of insects this pair of robins destroys in a day.

(5) The food habits of birds make them especially valuable to agriculture. Because birds have higher body temperatures, more rapid digestion, and greater energy than most other animals, they require more food. Nestling birds make extremely rapid growth, requiring huge amounts of food. They usually consume as much or more than their own weight in soft-bodied insects every day.

C. Suggested Evaluation

Evaluate the student based on his degree of participation, not on the skills he displays. Develop a participation rating scale of one to ten with ten being the highest score he can attain. Rate each student for each activity in which he is involved.

D. Suggested Resources

Resource people can be selected from those presented for the first objective of the exploration unit, pages 65-68.

# SUPPORTIVE MATERIALS FOR UNIT THREE

## REFERENCE LIST FOR UNIT THREE

Books

1. Agriculture natural resources and environment careers in general

   a. Career Education in the Enviornment: A Handbook by Olympus Research Corporation, Government Printing Office.

   b. Careers for the 70's: Conservation by Ed Dodd, Crowell-Collier Press, 1971.

   c. Careers in Conservation: Opportunities in Natural Resources by Henry Clepper, The Roland Press Company, 1963.

   d. Encyclopedia of Careers and Vocational Guidance, Volume II by J. G. Hopke, Ferguson Publishing Company.

   e. Experience Programs for Learning Vocations in Agriculture by Harold R. Binkley and Carsie Hammonds, The Interstate Printers and Publishers, Inc., 1970.

   f. Exploring Agriculture by Everett F. Evans and Roy L. Donahue, Prentice-Hall, Inc.

   g. Handbook of Agricultural Occupations by Norman K. Hoover, The Interstate Printers and Publishers, Inc.

   h. Occupational Outlook Handbook by U. S. Department of Labor, Government Printing Office.

   i. Opportunities in Environmental Careers by Odom Fanning, National Foundation for Enviornmental Control.

   j. Your Future in Agriculture by Chester S. Hutchison, Richards Rosen Press, Inc.

2. Air

   a. Air Pollution by A. C. Stern, 2nd edition, 1968.

   b. The Automobile and Air Pollution: A Program for Progress, Parts 1 and 2, by U. S. Department of Commerce, Government Printing Office.

   c. The Battle for Clean Air by Edward Edelson, Public Affairs Committee, Inc., 1970.

*Addresses of publishers can be found in the Appendix.

d. The Effects of Air Pollution by the U. S. Department of Health, Education and Welfare, Public Health Service, Government Printing Office, 1967.

e. Environmental Quality: The First Annual Report of the Council on Environmental Quality, Government Printing Office, 1970.

f. In Quest of Cleaner Air and Water, American Iron and Steel Institute, American Iron and Steel Institute.

g. Modern Earth Science by William L. Ransey and Raymond A. Burchley, Holt, Rinehart and Winston, Inc., 1965.

h. Needed: Clean Air: The Facts About Air Pollution by L. Bete Company, Inc., 1970.

i. Poisons in the Air by Ed Edelson and Fred Warshofsky, Public Affairs Committee, 1966.

j. Ralph Nader's Study Group Report on Air Pollution: Vanishing Air by John C. Esposito, Grossman Publishers, 1970.

k. Take Three Giant Steps to Clean Air, U. S. Department of Health, Education and Welfare, Government Printing Office, 1970.

l. The Unclean Air by Louis Batlan, Doubleday, 1966.

m. Wastes in Relation to Agriculture and Forestry by Cecil H. Wadleigh, United States Department of Agriculture Miscellaneous Publication 1065, Government Printing Office, 1968.

n. Wood, Pulp and Paper and People in the Northwest by Alfred J. Hall, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon, 1970.

o. Yearbook of Agriculture, "Outdoors USA," by United States Department of Agriculture, Government Printing Office, 1967.

p. Yearbook of Agriculture, "A Place to Live," by United States Department of Agriculture, Government Printing Office, 1963.

q. Yearbook of Agriculture, "Science for Better Living," by United States Department of Agriculture, Government Printing Office, 1968.

r. Yearbook of Agriculture, "Soil," by United States Department of Agriculture, Government Printing Office, 1957.

3. Chemicals

a. Agriculture and the Quality of Our Environment by Nyle C. Brady, American Association for the Advancement of Science, Washington, DC, 1967.

b. The Arthur Godfrey Environmental Reader, Arthur Godfrey, ed., Ballantine Books, 1970.

c. Conservation Yearbook, No. 4 by U. S. Department of the Interior, "Man . . . An Endangered Species?", Government Printing Office, 1968.

d. The Destruction of California by Raymond F. Dasmann, Collier-Macmillan, 1966.

e. Ecology Crisis: God's Creation and Man's Pollution by John W. Klotz, Concordia Publishing House, 1971.

f. Ecotactics: The Sierra Club Handbook for Environmental Activists by John C. Mitchell, Pocket Books, 1970.

g. Environmental Quality: The First Annual Report of the Council on Environmental Quality, Government Printing Office, 1970.

h. Environmental Quality: The Second Annual Report of the Council on Environmental Quality, Government Printing Office, 1971.

i. Environmental Quality: The Third Annual Report of the Council on Environmental Quality, Government Printing Office, 1972.

j. National Wildlife Federation's 1971 National E Q Index, National Wildlife Federation, 1971.

k. Population, Resources, Environment: Issues in Human Ecology by Paul R. Ehrlich and Anne H. Ehrlich, W. H. Freeman Company, 1970.

l. Report of the Secretary's Commission on Pesticides and Their Relationship to Environmental Health: Parts I and II, U. S. Department of Health, Education and Welfare, Government Printing Office, 1969.

m. Silent Spring by Rachel Carson, Fawcett Publications, Inc. 1962.

n. Yearbook of Agriculture, "Animal Diseases," U. S. Department of Agriculture, Government Printing Office, 1956.

o. Yearbook of Agriculture, "Contours of Change," U. S. Department of Agriculture, Government Printing Office, 1970.

p. Yearbook of Agriculture, "Food For Us All," U. S. Department of Agriculture, Government Printing Office, 1969.

q. Yearbook of Agriculture, "Insects," U. S. Department of Agriculture, Government Printing Office, 1952.

r. Yearbook of Agriculture, "Protecting Our Food," U. S. Department of Agriculture, Government Printing Office, 1966.

s. Yearbook of Agriculture, "Science For Better Living," U. S. Department of Agriculture, Government Printing Office, 1968.

4. Fish

a. Commercial Catfish Farming by Jasper S. Lee, The Interstate Printers and Publishers, Inc., 1973.

b. Construction Costs, Operational Expenses, and Methods Employed in Fish Farming, U. S. Department of the Interior, Government Printing Office.

c. How to Manage a Trout Farm, U. S. Department of Agriculture, Government Printing Office.

5. Health

a. Health, A Consumer's Dilemma by Robert E. Kime, Wadsworth Publishing Company, 1970.

b. How To Live In Our Polluted World by May Bethel, Pyramid Books, 1968.

c. Poisons in the Air by Ed Edelson and Fred Warshofsky, Pocket Books, 1966.

d. Poisons in Your Food by Ruth Winter, Crown Publishing Company, 1969.

e. So Human An Animal by Rene Dubos, Charles Scribner's Sons, 1969.

f. Yearbook of Agriculture, "Protecting Our Food," U. S. Department of Agriculture, Government Printing Office, 1966.

g. Yearbook of Agriculture, "Science For Better Living," U. S. Department of Agriculture, Government Printing Office, 1968.

6. Land Use

a. Agriculture and the Quality of Our Environment by Nyle C. Brady, American Association for the Advancement of Science, 1967.

b. Environmental Quality: The First Annual Report of the Council on Environmental Quality, Government Printing Office, 1970.

c. Environmental Quality: The Second Annual Report of the Council on Environmental Quality, Government Printing Office, 1971.

d. Environmental Quality: The Third Annual Report of the Council on Environmental Quality, Government Printing Office, 1972.

e. Journal of Soil and Water Conservation, "A New Policy Direction for American Agriculture," Marion Clawson, January-February, 1970.

f. Land Problems and Politics by John F. Timmons and William G. Murray, eds., Iowa State College Press, 1950.

g. Land Resource Economics: The Political Economy of Rural and Urban Land Resource Use by Raleigh Barlowe, Prentice-Hall, Inc., 1958.

h. Land Use Policy and Problems in the United States by Howard W. Ottoson, ed., University of Nebraska Press, 1963.

i. Population, Resources, Environment: Issues in Human Ecology by Paul R. Ehrlich and Anne H. Ehrlich, W. H. Freeman Company, 1970.

j. Yearbook of Agriculture, "Land," U. S. Department of Agriculture, Government Printing Office, 1958.

k. Yearbook of Agriculture, "A Place to Live," U. S. Department of Agriculture, Government Printing Office, 1963.

7. Mineral and Mineral Fuels

a. Dana's Manual of Mineralogy, 17th edition by D. S. Hurlbut, Wiley, 1959,

b. A Field Guide to Rocks and Minerals, 3rd edition by F. H. Pough, Houghton Mifflin, 1960.

c. The Rock Book by C. L. Fenton and M. A. Fenton, Doubleday, 1940.

d. Rocks and Minerals by H. S. Zim, Golden Press, 1957.

8. Noise

a. Environmental Quality: The First Annual Report of the Council on Environmental Quality, Government Printing Office, 1970.

b. Environmental Quality: The Second Annual Report of the Council on Environmental Quality, Government Printing Office, 1971.

c. Environmental Quality: The Third Annual Report of the Council on Environmental Quality, Government Printing Office, 1972.

d. Farm Safety Review, March-April, 1970, "Noise . . . The Third Pollution," by William J. Fletcher, National Safety Council, Chicago, IL, 1970.

e. The Fight for Quiet by Theodore Berland, Prentice-Hall, Inc., 1970.

f. Noise by Rupert Taylor, Penguin Books, Inc., 1970.

g. Noise . . . The Third Pollution by Theodore Berland, Public Affairs Committee, 1970.

h. In Quest of Quiet by Henry Still, Stackpole Books, 1970.

9. Parks and Natural Areas

a. The Arthur Godfrey Environmental Reader, Arthur Godfrey, ed., Ballantine Books, Inc., 1970.

b. Ecology Crisis: God's Creation and Man's Pollution by John W. Klotz, Concordia Publishing House, 1971.

c. Management of Forest Resources for Multiple Use by Quentin A. Hine and Norman K. Hoover, Pennsylvania State University, 1970.

d. Yearbook of Agriculture, "Land," U. S. Department of Agriculture, Government Printing Office, 1958.

e. Yearbook of Agriculture, "A Place to Live," U. S. Department of Agriculture, Government Printing Office, 1963.

f. Yearbook of Agriculture, "Outdoors USA," U. S. Department of Agriculture, Government Printing Office, 1967.

10. Range

a. Introduction to Agronomy by R. S. Dunham, The Dryden Press, Inc. 1957.

b. Yearbook of Agriculture, "Grass," U. S. Department of Agriculture, Government Printing Office, 1948.

11. Recreation

a. Campgrounds for Many Tastes, U. S. Department of Agriculture Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah, 1963.

b. Forest Recreation by Robert W. Douglass, Pergamon, Elmsford, NY, 1969.

c. Handbook of Outdoor Recreation Enterprises in Rural Areas, U. S. Department of Agriculture, Farmers Home Administration, Government Printing Office, 1966.

d. Land and Water for Recreation by Marion Clawson, Rand McNally and Company, 1963.

e. Outdoor Recreation for America, U. S. Department of Health, Education and Welfare, Outdoor Recreation Resources Review Commission, Government Printing Office, 1962.

f. Outdoor Recreation In America by Chayre R. Jensen, Burgess, 1970.

g. Recreational Use of Wild Land by Christian Frank Brockman, McGraw-Hill Book Company, Inc., 1959.

h. Summaries of Selected Publications on Rural Outdoor Recreation, U. S. Department of Agriculture, Government Printing Office, 1964.

i. Yearbook of Agriculture, "A Place to Live," U. S. Department of Agriculture, Government Printing Office, 1963.

j. Yearbook of Agriculture, "Outdoors USA," U. S. Department of Agriculture, Government Printing Office, 1967.

12. Soil

a. Fundamentals of Soil Science by Lloyd M. Turk and Henry Foth, Wiley.

b. The Nature and Properties of Soil, 7th edition, by Robert C. Buckman and Nyle C. Brady, Macmillan Company, 1969.

c. Our Soils and Their Management by Roy Donahue, The Interstate Printers and Publishers, Inc., 1970.

d. Profitable Soil Management by Leo L. Knuti, Milton Korpi and J. C. Hide, Prentice-Hall, Inc. 1969.

13. Solid Waste

a. Garbage As You Like It by Jerome Goldstein, Rodale Books, Inc., 1969.

b. Sanitary Landfill . . . An Answer to a Community Problem, A Route to a Community Asset, U. S. Department of Health, Education and Welfare, Government Printing Office, 1970.

c. The Solid Waste Fact Book, Glass Container Manufacturers Institute, Glass Containers Manufacturers Institute, Inc., 1970.

d. Waste Management and Control, Committee on Pollution, National Academy of Sciences, 1966.

e. Wealth Out of Waste, U. S. Department of the Interior.

14. Water

a. A Primer on Waste Water Treatment, U. S. Department of the Interior, Government Printing Office, 1969.

b. Conservation Yearbook, No. 5, "It's Your World: . . . The Grassroots Conservation Story," U. S. Department of the Interior, Government Printing Office, 1969.

c. Conservation Yearbook, No. 4, "Man . . . An Endangered Species?" U. S. Department of the Interior, Government Printing Office, 1968.

d. Conservation Yearbook, No. 2, "The Population Challenge . . . What It Means to America," U. S. Department of the Interior, Government Printing Office, 1966.

e. Conservation Yearbook, No. 1, "Quest for Quality," U. S. Department of the Interior, Government Printing Office, 1965.

f. Conservation Yearbook, No. 6, "River of Life, Water: The Environmental Challenge," U. S. Department of the Interior, Government Printing Office, 1970.

g. Environmental Quality: The First Annual Report of the Council on Environmental Quality, Government Printing Office, 1970.

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j. Waste in Relation to Agriculture and Forestry by Cecil H. Wadleigh, U. S. Department of Agriculture, Miscellaneous Publication 1065, Government Printing Office, 1968.

k. The World of Water by William C. Walton, Weidenfeld and Nicolson, 1970.

l. Yearbook of Agriculture, "A Place to Live," U. S. Department of Agriculture, Government Printing Office, 1963.

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n. Yearbook of Agriculture, "Land," U. S. Department of Agriculture, Government Printing Office, 1958.

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q. Yearbook of Agriculture, "Soil," U. S. Department of Agriculture, Government Printing Office, 1957.

r. Yearbook of Agriculture, "Water," U. S. Department of Agriculture, Government Printing Office, 1955.

15. Wildlife

a. Animal Parasites: Their Biology and Life Cycles by Wilford O. Olsen, Burgess Publishing Company, 1967.

b. Conserving Our Wildlife: An Introductory Guide for Teaching of Conservation Problems Relating to Wildlife, Standard Oil Company, 1962.

c. Environmental Quality: The First Annual Report of the Council on Environmental Quality, Government Printing Office, 1970.

d. Environmental Quality: The Second Annual Report of the Council on Environmental Quality, Government Printing Office, 1971.

e. Environmental Quality: The Third Annual Report of the Council on Environmental Quality, Government Printing Office, 1972.

f. Habitat Improvement: Key to Game Abundance by Werner O. Nagel, National Wildlife Federation, 1956.

g. National Wildlife Federation's 1970 National E Q Index: America is in Trouble, National Wildlife Federation, 1970.

h. The Nature of Parasitism: The Relationship of Some Metazoan Parasites to Their Host by W. P. Rogers, Academic Press, 1962.

i. Wildlife of Farm and Field by John D. Bulger, National Wildlife Federation, 1969.

j. Wildlife of Forest and Rangelands by William L. Reavely, National Wildlife Federation, 1964.

k. Wildlife of Lakes, Streams, and Marshes by H. R. Morgan, National Wildlife Federation, 1956.

l. Wildlife Management and Conservation by James B. Trefethen, D. C. Heath and Company, 1964.

m. Yearbook of Agriculture, "Animal Diseases," U. S. Department of Agriculture, Government Printing Office, 1956.

n. Yearbook of Agriculture, "Science For Better Living," U. S. Department of Agriculture, Government Printing Office, 1968.

Bulletins and Circulars

1. "A Career for You in Wildlife Conservation," The Wildlife Society.

2. "Agriopportunities," American Cyanamid Company.

3. "An Engineering Career for You in the Soil Conservation Service," No. 715, Soil Conservation Service, U. S. Department of Agriculture.

4. "Careers in Landscape Architecture," College of Agriculture and Environmental Science, Rutgers State University.

5. "Careers in Soil Conservation Service," No. 717, Soil Conservation Service, U. S. Department of Agriculture.

6. "Students--Start Your Career in Soil Conservation Service Before You Graduate," No. 714, Soil Conservation Service, U. S. Department of Agriculture.

Films

1. "Dynamic Careers Through Agriculture," This film shows the opportunities in agribusiness for young people. Farm Film Foundation, 1425 H Street, N.W., Washington, DC 20005.

Note: The following filmstrips can be ordered from Vocational Education Production, California State Polytechnic College, San Luis Obispo, California 93401.

2. "Air and the Agricultural Environment."

3. "Careers in Government Services."

4. "Careers in Natural Resources Management."

5. "Ecology and the Agricultural Environment."

6. "People and the Agricultural Environment."

7. "Water and the Agricultural Environment."

Note: It is suggested that you order the following listing of films:

8. "Color Filmstrips and Slide Sets of the United States Department of Agriculture," Miscellaneous Publication No. 1107, U. S. Department of Agriculture, Office of Information, Photography Division, Washington, DC 20250.

9. "A Film Guide on Pesticides," National Agricultural Chemicals Association, 1155 15th Street, N.W., Washington, DC 20005.

10. "Free Films on: Air Pollution," National Air Pollution Control Administration, Environmental Protection Agency, Waterside Mall, 401 M Street, S.W., Washington, DC 20460.

11. "Motion Pictures of the U. S. Department of Agriculture," Motion Picture Service, Office of Information, U. S. Department of Agriculture, Washington, DC 20250.

12. "1973-74 Listing of . . . Conservation and Environmental Films . . . and Related Natural Resource Film Subjects," United States Department of the Interior, Interior Building, Washington, DC 20240.

GENERAL EXPLORATION FORM

1. Name of the occupation _____

2. Name of the person or business visited _____

3. Job title _____

4. Job family _____

5. What was the primary function of the job? _____

_____

6. What were the major activities being conducted?

   a. _____

   b. _____

   c. _____

7. What competencies were required for success on the job? _____

_____

_____

8. What was your general opinion of the job observed in terms of

   a. Working conditions? _____

   b. Items or materials working with? _____

   c. Difficulty of tasks performed? _____

9. Would you enjoy this job? _____yes _____no Why?

_____

_____

_____

AUDIO-VISUAL REPORT

1. Type of presentation: _____

2. Title: _____

3. Theme of presentation: _____

_____

4. Information I received from this presentation: _____

_____

_____

_____

_____

_____

_____

5. How can I apply this to my life? _____

_____

_____

_____

_____

_____

_____

6. How was this presentation helpful to me? (Explain) _____

_____

_____

_____

_____

_____

_____

IN-DEPTH CAREER EXPLORATION

1. What is the specific job title? _____

2. What is the employment outlook concerning the occupation?

   a. Present _____

   _____

   b. Future _____

   _____

3. What duties does the worker perform? _____

   _____

4. Do these duties vary? How? _____

   _____

5. What equipment is used on the job? _____

   _____

6. What materials are handled? _____

   _____

7. Is the work indoors or outdoors? _____

   _____

8. How many hours are usually worked each week? _____

   _____

9. What are the surrounding conditions related to the occupation?

   _____

10. How much education is required? High school? _____

    Technical school? _____ College? _____

    Other _____

11. What is the usual beginning salary? _____

12. What increases are expected in salary? What are the conditions?

_____

13. What are the fringe benefits in terms of sick leave, insurance, etc.?

_____

_____

14. What qualifications, other than educational, are necessary?

a. Physical _____

b. Mental _____

c. Aptitude _____

d. Personality _____

15. What are some jobs related to this occupation? _____

_____

16. What interests of yours would this job satisfy? _____

_____

17. What abilities of yours is this job related to? _____

_____

18. What would be the advantages of this job being your occupational choice? _____

_____

_____

19. What would be the disadvantages of this job being your occupational choice? _____

_____

_____

20. Would you like to explore this occupation in even greater depth?

_____

UNIT FOUR

EDUCATIONAL OPPORTUNITIES

IN

NATURAL RESOURCES AND ENVIRONMENT

UNIT PURPOSE: The student will identify opportunities for training in the natural resources and environment cluster area.

PERFORMANCE OBJECTIVES: The student will be able to

I. List sources of information concerning training in natural resources and environment.

II. List general educational requirements for a career in natural resources and environment.

III. List training areas available for receiving occupational training in the area of natural resources and environment.

IV. List the steps to follow in order to become trained in one job of interest in natural resources and environment.

I. The student will be able to list sources of information concerning training in natural resources and environment.

A. Suggested Content

1. Information sources

a. Individuals

(1) Parents
(2) Teachers
(3) Guidance personnel
(4) Other students
(5) People in natural resources and environment
(6) Agricultural extension agent
(7) Vocational agriculture teacher
(8) Other, etc.

b. Brochures and catalogs

(1) School catalogs
(2) Brochures
(3) Other, etc.

2. Students must become aware of the different sources of informational aid concerning training in natural resources and environment.

B. Suggested Teaching-Learning Activities

1. Involve the student in writing a paper, "Who Would I Talk With If I Wanted Information Concerning My Educational Future?"

2. Invite into the classroom a college student majoring in natural resources and environment. Let him discuss who he talked with or where he received the most information concerning training in natural resources and environment.

3. Invite into the classroom a person successfully employed in the area of natural resources and environment. Let him discuss his primary sources of information concerning training in natural resources and environment.

4. Involve the student in studying school catalogs and brochures from different educational agencies which should be available in the school library or the agricultural library.

5. Show transparency NRE-7, "Sources of Information," page 120. Involve the student in adding to the list.

C. Suggested Evaluation

Compile a list of information sources concerning natural resources and environment. The student will select the three primary sources and explain his choices. Evaluate the student based on his written or oral discussion of his three choices.

D. Suggested Resources

1. Resource persons
   a. Guidance personnel
   b. People employed in natural resources and environment
   c. Vocational agriculture teacher
   d. County extension agent
2. Bulletins
   a. School catalogs
   b. School brochures
3. Transparency Master NRE-7, p. 120.

II. The student will be able to list general educational requirements for a career in natural resources and environment.

A. Suggested Content

1. Educational requirements for success in all areas of natural resources and environment include the following areas:

   a. Plant science
   b. Soil science
   c. Animal science
   d. Agricultural mechanics
   e. Business management
   f. Record keeping
   g. Other

2. Basic skills through educational training must also be developed in the following areas:

   a. Public relations
   b. Basic math
   c. English

3. Other educational requirements will depend on the level at which the individual will become employed in natural resources and environment.

   a. Professional
   b. Technical
   c. Skilled

B. Suggested Teaching-Learning Activities

1. Student can review occupational analysis forms completed during the exploration phase of the guide to determine general educational requirements for different jobs.

2. Student can review occupational briefs in the literature or those furnished in the Appendix, pages 149-265 of the guide, to determine general educational requirements.

3. A panel of resource people can be formed from the different job family areas of natural resources and environment with the specific task of discussing educational requirements for success in natural resources and environment.

4. A panel of students can be formed. The panel will consist of a student who, during the exploration phase, studied a particular job family area of natural resources and enviornment. Each job family area will be represented by one student. Dialogue can be stimulated through questions concerning the educational requirements for success in natural resources and environment.

5. The guidance counselor, vocational agriculture teacher, or local county agent can visit the class and discuss the educational requirements for success in natural resources and environment.

6. Involve the student in completing the exercise in basic agricultural math found on pages 122-123. Stress the importance of mathematical skills to success in natural resources and environment.

C. Suggested Evaluation

Compile a list of educational requirements for both natural resources and environment and other occupational areas. The student will select those educational requirements required for success in natural resources and environment. Evaluate the student based on the number of correct selections made.

D. Suggested Resources

1. Resource persons

   a. Guidance counselor

   b. Vocational agriculture teacher

   c. County extension agent

2. Books

   a. Handbook of Agricultural Occupations, pp. 43-47.

   b. Careers in Agribusiness and Industry, Ch. 4.

3. Appendix of the Guide

   a. Occupational Briefs, pp. 149-265.

III. The student will be able to list training areas available in natural resources and environment.

A. Suggested Content

1. Training areas available

a. Home
b. Business
c. High school

(1) Day classes
(2) Evening classes

d. Trade or vocational school
e. Technical school
f. Community or junior college
g. Four year colleges and universities
h. Other

2. The training area chosen will depend on the level at which the individual plans to enter the occupation.

a. Professional
b. Skilled

B. Suggested Teaching-Learning Activities

1. Guidance counselor can discuss with the student training areas available, location of area, and requirements for entry.

2. Student can visit high school agriculture, natural resources and environment classes under teacher supervision.

3. Form a panel of agriculture, natural resources and enviornment students who can discuss high school agriculture, natural resources and environment programs with the other students.

4. Resource people from different areas of natural resources and environment can be involved in discussing the areas where they received their training.

5. Field trips under teacher supervision can be taken to vocational school or colleges and universities. A field trip report form such as the one found on page 124 should be completed.

6. Set up an educational display depicting materials from different educational agency sources from which the student can study.

7. A student who is presently employed in a cooperative work experience program can be visited on a field trip or brought into the class as a resource individual.

8. Show transparency NRE-8, "Training Areas Available," page 121. Involve the student in adding to the list of training areas.

C. Suggested Evaluation

1. The student will write a brief report, "Where I Would Go To Receive Training in Natural Resources and Environment." Evaluate the report based on the adequacy of development.

2. Compile a list of training areas available for natural resources and environment. The student will select three areas he feels most important and tell why. Evaluate the student based on his written or oral discussion of his three choices.

D. Suggested Resources

1. Resource persons

   a. Agriculture, natural resources and environment teacher

   b. County agent

   c. Soil conservation agent

   d. Agriculture, natural resources and environmental students

   e. College and university public relations individuals

2. Books

   a. Experience Programs for Learning Vocations in Agriculture.

   b. Careers in Agribusiness and Industry, pp. 36-40, 44-45.

3. Bulletins and Circulars

   a. School catalogs

   b. School brochures and circulars

4. Transparency Master NRE-8, p. 121.

IV. The student will be able to list the steps to follow in order to become trained in one job of interest in natural resources and environment.

A. Suggested Content

1. Identify primary sources of information

a. Parents
b. Guidance personnel
c. Teachers, etc.

2. Identify general educational requirements

a. Plant science
b. Soil science, etc.

3. Identify primary training areas available

a. Home
b. High school
c. Vocational school, etc.

B. Suggested Teaching-Learning Activities

1. Involve the student in selecting one job of interest and determining the steps to follow in order to become trained in that job.

a. Example: Soil scientist

(1) Sources of information

--Soil scientist
--Teacher of vocational agriculture
--County agent

(2) Areas training needed

--Soil science
--Plant science
--Mechanics
--Record keeping

(3) Places where training could be given

--Home
--High school agriculture, natural resources and environment classes
--Cooperative placement
--College or university

2. Teacher can select from the community different successful resource people in natural resources and environment and let these individuals discuss the steps they followed in order to reach their success level in terms of the three areas in the content outline.

3. Teacher can set up individual or group counseling sessions involving the student and parents, guidance counselors, or people employed in natural resources and environment.

4. Student can review material in the resource center secured during the exploration phase of the guide.

C. Suggested Evaluation

The student will prepare a written or oral report concerning the steps to follow in order to become trained in a specific job in natural resources and environment. Evaluate the student based on the number of steps he includes as presented in the content.

D. Suggested Resources

1. Resource persons

   a. Guidance counselor

   b. People employed in natural resources and environment

   c. Parents

2. Books

   a. Experience Programs for Learning Vocational Agriculture, Chs. 24-30.

   b. Handbook of Agricultural Occupations, Chs. 6-14.

   c. Careers in Agribusiness and Industry, Ch. 13.

3. Appendix of the Guide

   a. Occupational Briefs, pp. 149-265.

# SUPPORTIVE MATERIALS FOR UNIT FOUR

## REFERENCE LIST FOR UNIT FOUR

Books


1. Careers in Agribusiness and Industry by Archie A. Stone, The Interstate Printers and Publishers, Inc.

2. Experience Programs for Learning Vocations in Agriculture by Harold R. Binkley and Carsie Hammonds, The Interstate Printers and Publishers, Inc.

3. Handbook of Agricultural Occupations by Norman K. Hoover, The Interstate Printers and Publishers, Inc.


*Addresses of publishers can be found in the Appendix.

# SOURCES OF INFORMATION

1. Individuals

   --Parents

   --Teachers

   --Guidance personnel

   --Other students

   --People in natural resources and environmental occupations

2. Written Material

   --School catalogs

   --School brochures

## TRAINING AREAS AVAILABLE

1. Home
2. Businesses
3. High school
4. Trade or vocational school
5. Technical school
6. Community or junior college
7. Four year colleges and universities

BASIC NATURAL RESOURCES AND ENVIRONMENT MATHEMATICS

(Can you make the correct calculations?)

Instructions: Complete your calculations in the space provided below each problem and place your answer in the blank space provided.

1. If a fish farmer is going to grow catfish in a tank and the tank is fifty feet long, 10 feet wide and 5 feet deep, and can be filled to the top, how many fish can he grow in this tank if each fish requires one square foot of water?

ANSWER _____ fish

2. If you have an incubator that holds 100 eggs and you can expect 75% of the eggs to produce healthy 5 week old birds, and if a new batch of birds can be incubated each 21 days, how many weeks will it take to produce 675 birds at least five weeks old?

ANSWER _____ weeks

3. If you were to plant an area 36 feet by 108 feet with trees six feet apart, how many trees would be required?

ANSWER _____ trees

4. Water weighs approximately 8.6 pounds per gallon. If you were to haul five 55-gallon drums full of water and each drum weighed 30 pounds, how many total pounds would you be hauling?

ANSWER _____ pounds

5. How many tons of soil would you have to move to take 2 feet off one-fourth of an acre? Soil weighs 80 pounds per cubic foot. An acre is 160 square rods and a rod is 16.5 feet. A ton is 2,000 pounds.

ANSWER _____ pounds

FIELD TRIP REPORT (Date) _____

1. Place of visit: _____

2. Time: _____ Date: _____

3. Purpose of trip: _____

_____

4. Areas and specialties we saw: _____

_____

_____

_____

_____

5. People we met: _____

_____

_____

_____

6. Brief summary of trip: _____

_____

_____

_____

_____

_____

_____

_____

7. What did you enjoy most about the trip: _____

_____

_____

_____

# UNIT FIVE

## EVALUATION OF SELF IN RELATION TO A CAREER IN THE CLUSTER AREA OF NATURAL RESOURCES AND ENVIRONMENT

UNIT PURPOSE: To analyze self in relation to a career in natural resources and environment.

PERFORMANCE OBJECTIVES: The student will be able to

I. Identify general characteristics and competencies needed for success in a natural resources and environment occupation.

II. List the factors to consider in deciding on a career in natural resources and environment.

III. Identify counseling sources for giving aid in making a career choice.

IV. Inventory self in relation to a career in natural resources and environment.

I. The student will be able to identify general characteristics and competencies needed for success in a natural resources and environment occupation.

A. Suggested Content

1. Knowledge of basic intellectual tools is required for success.

a. Reading

b. Communication, written and oral

c. Arithmetic

d. American free enterprise system

2. Desirable social-personal qualities are required for success.

a. Pleasing personal appearance

(1) Grooming
(2) Poise
(3) Voice
(4) Posture

b. Enthusiasm

c. Honesty and dependability

d. Initiative and ambition

e. Friendliness

f. Cooperation and courtesy

g. Punctuality

h. Self confidence and control

i. Businesslike manner

3. Physical characteristics or traits to consider, relating to success in natural resources and environment.

a. Physical strength

b. Eyesight

c. Height and weight

d. Hearing

e. Speech

B. Suggested Teaching-Learning Activities

1. Involve the student in discussing the subject, "The Most Interesting Person I Know."

2. Involve the student in making a list of "The Traits I Possess Which Will Aid Job Success." Put a cumulative list on the board and discuss.

3. Involve the student in writing a brief report on the subject, "Why I Like or Dislike People."

4. Involve the student in discussing the importance of physical characteristics to job success.

5. Divide the class into pairs. Have each individual analyze the other individual in terms of their desirable and undesirable traits. Involve the student in making a list of the characteristics of his partner.

   a. Traits to consider and discuss

      (1) Physical strength
      (2) Eyesight
      (3) Height and weight
      (4) Hearing
      (5) Speech
      (6) Other

C. Suggested Evaluation

The student will list and discuss three general characteristics which he feels he possesses which will aid his success in natural resources and environment. Evaluate the student based on his adequacy of discussion.

D. Suggested Resources

1. Resource persons

   a. Guidance counselor

2. Books

   a. Experience Programs for Learning Vocations in Agriculture, pp. 57-63.

   b. Handbook of Agricultural Occupations, pp. 39-41.

II. The student will be able to list the factors to consider in deciding on a career in natural resources and environment.

Note: This objective is to involve the student in reviewing the information secured during the exploration phase concerning the different jobs in natural resources and environment.

A. Suggested Content

1. Factors to study

a. Employment outlook

(1) Present
(2) Future

b. Nature of the work

(1) Duties performed
(2) Advantages of the job
(3) Disadvantages of the job
(4) Working conditions

--Salary
--Hours
--Fringe benefits

c. Personal qualities required

(1) Interests
(2) Physical abilities
(3) Mental abilities

d. Qualifications for employment

(1) Formal education
(2) On-the-job training
(3) Previous work experience

B. Suggested Teaching-Learning Activities

1. Teacher should involve the student in reviewing the information secured concerning the different job families and job titles during the exploration phase of the guide.

2. Involve the student in reviewing occupational briefs found in the Appendix of the guide, pages 149-265.

3. Students may gather additional information concerning a particular job title or job family from selected sources of interest.

4. Student interest in a particular job family or job title may facilitate the need for an additional resource person or field trip to secure in-depth information.

5. Teacher should hold each student responsible for studying at least two job titles concerning the factors to consider in choosing a career in this area. In-depth exploration forms should be completed.

6. Involve the students in giving oral reports concerning the job titles or job family which they have studied in depth.

C. Suggested Evaluation

The student will write a brief summary of the occupation or job family he is most interested in. Evaluate the student based on the number of areas covered in the summary as outlined in the content.

D. Suggested Resources

1. The resources for this objective can be taken from those listed for Objective 2 in Unit 3.

2. The resources used will depend on student needs and interests.

III. The student will be able to identify counseling sources available for giving aid in making a career choice.

A. Suggested Content

1. Sources of counseling

a. Parents

(1) Parents are very interested in the career that their child will chose; therefore, their opinions should be carefully considered.

b. Guidance counselors

(1) Guidance counselors have special training in counseling students about occupations.

(2) Guidance counselors have many sources of occupational information.

c. Teachers

(1) Teachers of special subjects are a good source of information.

d. Religious counselors

(1) Most religious counselors have special training and are sources of occupational information and guidance.

e. Kentucky Department of Economic Security

(1) This division of the state is concerned with employment and unemployment programs.

(2) This division is a source of testing, counseling, job placement, and labor market information.

f. Persons employed in the occupation

B. Suggested Teaching-Learning Activities

1. Involve the student in a round-table discussion on the subject, "The First Person I Talk to When I Have a Problem."

2. Show transparency NRE-9, "Counseling Sources," page 140, and conduct a discussion concerning different sources of information concerning occupations.

3. Conduct a teacher-led and student-involved discussion on the definition of guidance and also the sources of guidance.

4. Teacher should have principal or other individuals discuss with the class the people who helped them make a career choice.

C. Suggested Evaluation

The student will list the three primary sources of guidance he would use and explain why. Evaluate the student based on the written or oral discussion of his guidance choices.

D. Suggested Resources

1. Resource persons

   a. Principal

   b. Teachers in school

2. Books

   a. Guidance in Agricultural Education, Ch. 1.

   b. Planning Your Future, Ch. 3.

3. Transparency Master NRE-9, p. 140.

IV. The student will be able to inventory self in relation to a career in natural resources and environment.

A. Suggested Content

1. Each student must first realize that he or she is a unique and different individual. Even identical twins are different in many respects.

2. Personal qualities to consider

a. Interests

(1) People do best what they enjoy most.

(2) Satisfaction results from the selection of an occupation closely associated with one's interests.

b. Academic abilities

(1) Ability refers to capacity to perform

(2) Types

--Demonstrated
--Testing properly administered

c. Physical ability

(1) Different careers make different demands on health and physical ability.

(2) The choice of a career which enables the use of one's personal qualities leads to success.

B. Suggested Teaching-Learning Activities

1. Involve the student in discussing, "If I Could Have Any Job I Wanted--Which Would I Choose?"

2. Involve the student in choosing the particular job family he is most interested in at this point and tell why.

3. Teacher should involve the student in listing three jobs in natural resources and environment that he is most interested in at this time and have him tell why. Teacher will want the student to collect all pertinent information available concerning the job.

4. Have each student write an autobiography. These autobiographies may be read in class. A sample outline for an autobiography may be found on page 141.

5. Involve the student in completing the self-picture checklist. A sample can be found on page 142.

6. Teacher should have student (under the direction of guidance counselor) take the Kuder Interest Inventory or the Strong Vocational Interest Inventory. The guidance counselor must be involved in determining the results.

7. Involve the student in completing the form "Who Am I." A sample form can be found on pages 143-144.

8. Involve the student in completing the form "Grade Analysis." A sample form can be found on page 145.

9. Set up group counseling sessions for the student involving guidance counselors or other counselors.

   Note: These sessions will be to interpret information compiled on a general basis.

10. Plan individual counseling sessions for the student to discuss specific abilities in relation to specific job families or jobs.

11. Motivate the student to discuss with their parents discovered abilities and interests in relation to a career in natural resources and environment.

12. Involve the student, counselors, and parents in comparing discovered abilities and interests with the job family or specific jobs the student has shown the greatest amount of interest in. Student analysis and occupational analysis forms would be of great value here.

13. Involve the student in completing the form "My Plan From Here." A sample form can be found on page 146.

C. Suggested Evaluation

The student will take one job or one job family and identify reasons why he will or will not study the job or job family in greater depth. The reasons identified will be in relation to his particular characteristics and abilities. Evaluate the student based on the number of reasons given and the discussion of those reasons.

D. Suggested Resources

1. Resource persons

   a. Guidance counselors
   b. Parents
   c. Religious counselors
   d. Counselors employed by Office of Economic Security

2. Books

   a. Career Information in Counseling and Teaching, pp. 13-15.

   b. I Find My Vocation, Ch. 9.

   c. How To Get A Better Job, Ch. 3.

# SUPPORTIVE MATERIALS FOR UNIT FIVE

## REFERENCE LIST FOR UNIT FIVE

Books


1. Career Information in Counseling and Teaching by Lee E. Isaacson, Allyn and Bacon, Inc., 1971.

2. Experience Programs for Learning Vocations in Agriculture by Harold R. Binkley and Carsie C. Hammonds, The Interstate Printers and Publishers, Inc., 1970.

3. Guidance in Agricultural Education by Harold M. Byram, The Interstate Printers and Publishers, Inc., 1966.

4. Handbook of Agricultural Occupations by Norman K. Hoover, The Interstate Printers and Publishers, Inc., 1969.

5. How To Get A Better Job by Austin Marshall, The Appleton Century Company, 1964.

6. I Find My Vocation by Harry Dexter Kitson, The McGraw-Hill Book Company, 1954.

7. Planning Your Future by George E. Myers, Gladys Little and Sarah A. Robinson, The McGraw-Hill Book Company, 1953.


*Addresses of publishers can be found in the Appendix.

# COUNSELING SOURCES

1. Parents
2. Guidance Counselors
3. Teachers
4. Religious Counselors
5. Counselors Employed at the Division of Economic Security
6. Persons Employed in the Occupation

SAMPLE AUTOBIOGRAPHY OUTLINE

I. Early years

   A. Place of birth

   B. Date of birth

   C. Early life experiences and remembrances

II. Family

   A. Number in family

   B. Number of brothers and sisters

   C. Favorite family hobby

III. Experiences in school

   A. First five years in school

   B. From fifth grade till now

IV. Friends

   A. Who are they

   B. Things enjoyed together

V. Thing liked or disliked

VI. Future Goals

   A. Career

   B. Educational

   C. Other

SELF-PICTURE CHECKLIST

Place an X in the column which best describes you.

| | Always | Usually | Sometimes | Never |
|---|---|---|---|---|
| 1. Honest | | | | |
| 2. Happy | | | | |
| 3. Friendly | | | | |
| 4. Sad | | | | |
| 5. Serious | | | | |
| 6. Sensitive | | | | |
| 7. Jealous | | | | |
| 8. Popular | | | | |
| 9. Shy | | | | |
| 10. Clumsy | | | | |
| 11. Show-off | | | | |
| 12. Afraid | | | | |
| 13. Kind | | | | |
| 14. Modest | | | | |
| 15. Proud | | | | |
| 16. Lazy | | | | |
| 17. Neat | | | | |
| 18. Thrifty | | | | |
| 19. Even-tempered | | | | |
| 20. Dependable | | | | |
| 21. Angry | | | | |
| 22. Moody | | | | |
| 23. Open-minded | | | | |
| 24. Unreasonable | | | | |
| 25. Demanding | | | | |

WHO AM I?

1. What occupation in natural resources and environment would you engage in if given a choice? _____

_____

2. How did you become interested in this occupational area in natural resources and environment? _____

_____

3. What are your plans for the future as they relate to this occupation?

_____

4. What are your favorite hobbies? _____

_____

5. What subjects do you like in school? _____

_____

6. What subjects do you dislike? _____

_____

7. Do you enjoy working indoors or outdoors? _____

8. What clubs do you enjoy being a member of? _____

_____

9. What special abilities do you possess? _____

_____

10. What sports activities do you excel in? _____

_____

11. In what areas do your friends ask advice? _____

_____

12. Do you prefer to be a leader or a follower? _____

_____

13. How well do you get along with other people, friends, teachers, parents, etc.? _____

_____

14. What are the reasons you do not get along with some of the people mentioned above? _____

_____

15. What satisfaction would you like to get from your work? _____

_____

16. What vital information about yourself would interest an employer? Why?

_____

_____

17. What jobs have you engaged in which you really enjoyed? _____

_____

18. Why did you enjoy these jobs? _____

_____

19. What jobs have you engaged in which you really disliked? _____

_____

20. Do you think you would prefer to work with people, data, or things?

_____

21. What physical limitations do you possess? _____

_____

22. Do you value one life-style over another? _____

_____

23. If you could have any job in natural resources and environment you wanted, which would you choose? Why? _____

_____

24. What are your future ambitions or goals? _____

_____

## GRADE ANALYSIS

Note: The purpose of this form is to involve the student in analyzing his grades in relation to a future career choice.

1. In what subjects do you have the highest interest? _____

_____

2. In what subjects do you have the lowest interest? _____

_____

3. In what subject areas do you receive the highest grades? _____

_____

4. In what subject areas do you receive the lowest grades? _____

_____

5. Did you get the highest grades in the subjects in which you worked the hardest? Explain. _____

_____

_____

6. How well do your grades represent your working ability? _____

_____

7. How well do your grades represent your ability to memorize? _____

_____

8. What is the relationship between your grades and your reading ability?

_____

_____

MY PLAN FROM HERE

1. Have you made a tentative career choice in relation to natural resources and environment? _____

2. What is that choice? _____

_____

3. What caused you to make that decision? _____

_____

4. What are your plans now in relation to your career choice? _____

_____

_____

5. What knowledge and skills do you possess that will aid your success in your career choice? _____

_____

_____

6. What areas do you need additional knowledge, help, or skills in order to be a success in your career choice? _____

_____

_____

7. Where are some places you plan to visit or people you plan to talk with in order to gain additional knowledge or skills concerning your tentative career choice? _____

_____

_____

8. What is your next step in reaching your tentative career choice?

_____

_____

# APPENDIX

OCCUPATIONAL BRIEFS

OCCUPATIONAL TITLES

JOB FAMILY CONTENT

ADDRESSES OF PUBLISHERS

# OCCUPATIONAL BRIEFS

Note: In this section on occupational briefs, two or more jobs in each job family area will be analyzed in relation to employment outlook, nature of the work, qualifications, entrance and advancement.

Additional occupational briefs can be obtained from the following references:

1. Dictionary of Occupational Titles
2. Handbook of Agricultural Occupations
3. Experience Programs for Learning Vocations in Agriculture

These occupational briefs were adapted from "Occupational Outlook Handbook" and Exploring Occupations in the Natural Resources.

# AIR

AIR POLLUTION CONTROL AIDE

AIR POLLUTION CONTROL TECHNICIAN

AIR POLLUTION CONTROL SUPERVISOR

# AIR POLLUTION CONTROL AIDE

## USUAL DUTIES

The Air Pollution Control Aide serves as a helper to higher level employees. Many duties are learned by doing routine jobs. Assistance is given to others in jobs such as: analyzing air pollutants, checking air sampling equipment, keeping daily records, and fixing things. The Air Pollution Control Aide loads, unloads, and moves equipment; unpacks and stores equipment; collects, cleans, and distributes laboratory glassware; and keeps working areas neat and clean.

## CHARACTERISTICS OF THE JOB

The Air Pollution Control Aide works under close supervision. Through training, observation, and practice, the aide develops an understanding of the job. This person must be able to perform routine tasks, follow directions, follow safety precautions, and work with others. Work may be in a laboratory, or outdoors.

## QUALIFICATIONS

A high school diploma is essential, including a background in basic mathematics, reading, and speaking.

## EMPLOYMENT PROSPECTS

The job outlook for the new and emerging occupation, Air Pollution Control Aide, looks good. Many aides will be needed to assist technicians in their work. Many new programs in pollution control are developing.

Air Pollution Control Aides may be employed by the large agencies of the federal government. Large numbers of aides are employed by the Environmental Protection Agency (EPA). Aides also are employed by the Public Health Service of the U.S. Department of Health, Education, and Welfare, and the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce.

Air Pollution Control Aides may find employment at the state level with agencies such as the Department of Environmental Protection, Department of Environmental Resources, or Department of Health.

Employment opportunities also exist with many county or municipal governments because of increasing problems with air pollution from motor vehicles, industries, power plants, and high density urban population.

In the future, there should be more employment opportunities for Air Pollution Control Aides with businesses and industries that produce equipment to control air pollution. Also, industries now are employing air pollution personnel to operate, maintain, and repair their air pollution control equipment.

OPPORTUNITIES FOR ADVANCEMENT

With additional on-the-job experience or post high school education, the Air Pollution Control Aide may advance to Air Pollution Control Technician or other positions of greater responsibility.

# AIR POLLUTION CONTROL TECHNICIAN

## USUAL DUTIES

The Air Pollution Control Technician is trained to inspect industrial sites and enforce air pollution control laws. The technicians may install, operate, calibrate, maintain, and repair air sampling equipment. Technicians may conduct smokestack sampling tests, gather data for source and emission tests, and conduct standardized analyses of air pollutants. The job also includes keeping records, drawing charts, and making graphs of data obtained from air sampling equipment, meterological equipment, and laboratory analyses. Other duties include assisting higher-level staff in conducting complex tests, preparing oral and written reports of activities, and assisting lower-level employees. The job also includes maintaining an effective relationship with representatives of public and private agencies. The Air Pollution Control Technician may attend air pollution control hearings to present data and may be called as a witness in court cases.

## CHARACTERISTICS OF THE JOB

The Air Pollution Control Technician periodically uses air sampling devices in special areas to analyze the air quality. In performing some of the duties of the job, the technician uses methods described in equipment operating manuals, technical reports and journals, and in documents prepared by professional societies. The Air Pollution Control Technician works in the field as well as in a laboratory. Work is done with people from government, industry, and the general public.

## QUALIFICATIONS

The Air Pollution Control Technician must have a 2-year associate degree in air pollution control or a related field, or three years of experience in air pollution control or a related environmental program. Good health is necessary for field assignments, as well as ability and interest in mathematics, chemistry, and physics. Problem-solving skills are essential.

The Air Pollution Control Technician will come in direct contact with people representing various interests. Therefore, this person must be able to communicate effectively and work well with others.

## EMPLOYMENT PROSPECTS

The employment of technicians, one of the fastest growing occupational groups, is expected to continue expanding. The seriousness of environmental problems has caused government agencies and industry to start programs at ever-increasing rates, making the future in air pollution control very promising.

Air Pollution Control Technicians may be employed by the large agencies of the federal government. Large numbers of technicians are employed by the Environmental Protection Agency (EPA). Technicians also are employed by the Public Health Service of the U.S. Department of Health, Education, and Welfare, and the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce.

Air Pollution Control Technicians may find employment at the state level with agencies such as the Department of Environmental Protection, Department of Environmental Resources, or Department of Health.

Employment opportunities also exist with many county or municipal governments because of increasing problems with air pollution from motor vehicles, industries, power plants, and high density urban population.

OPPORTUNITIES FOR ADVANCEMENT

Air Pollution Control Technicians may advance to higher positions after performing satisfactory work for a number of years. A B.S. degree at a college or university is necessary to qualify for the more advanced positions, such as Air Quality Controller, Sanitarian, or Air Pollution Control Supervisor.

# AIR POLLUTION CONTROL SUPERVISOR

## USUAL DUTIES

The main job of the Air Pollution Control Supervisor is to plan a major segment of an air pollution control program. This involves supervising the operation of air monitoring equipment and reviewing requests for construction and operating permits. The supervisor also is responsible for investigating complaints, inspecting buildings and equipment, and conducting surveys and special studies. The supervisor also recommends new and better laws and regulations. This individual may appear in court to give evidence in legal violations, or speak to public and private groups to give general information or advice.

The Air Pollution Control Supervisor is responsible for all those working under him. He is in charge of recruiting new employees and organizing training programs.

## CHARACTERISTICS OF THE JOB

The Air Pollution Control Supervisor has a lot of responsibility. The job involves a variety of experiences--visiting industrial sites, attending lectures, or testifying in court hearings. Much of the work is done in an office. The chief responsibility is supervising others and keeping up-to-date on the progress of their work.

## QUALIFICATIONS

The Air Pollution Control Supervisor must have a degree from a 4-year accredited college or university plus at least three years of professional experience in an environmental program.

## EMPLOYMENT PROSPECTS

This is a job of great responsibility. The candidate for this position must have an excellent record of past work, including administrative ability, excellent public relations, and considerable knowledge and experience in this field.

Air Pollution Control Supervisors may be employed by the large agencies of the federal government. Many supervisors are employed by the Environmental Protection Agency (EPA). Supervisors also are employed by the Public Health Service of the U.S. Department of Health, Education, and Welfare, and the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce.

Air Pollution Control Supervisors may find employment at the state level with agencies such as the Department of Environmental Protection, Department of Environmental Resources, or Department of Health.

Employment opportunities also exist with many county or municipal governments because of increasing problems with air pollution from motor vehicles, industries, power plants, and high density urban population.

In the future, there should be more employment opportunities for Air Pollution Control Supervisors with industry that produces equipment to control air pollution.

OPPORTUNITIES FOR ADVANCEMENT

The Air Pollution Control Supervisor may advance to a higher level administrative position. Requirements for these positions usually include several years of experience in the field of air pollution control and, often, a graduate degree.

## CHEMICALS AND RADIATION

LIFE SCIENTIST

BIOCHEMIST

CHEMIST

RADIOLOGIC TECHNOLOGIST

OCCUPATION IN ATOMIC ENERGY

# LIFE SCIENTIST

## USUAL DUTIES

Life scientists study living organisms, their structure, evolutionary development, behavior, and life processes. They emphasize the relationship between animals, plants, and microorganisms and their environments. The number and variety of plants and animals are so vast and the life processes so varied and complex that life scientists must specialize in one of three broad areas--agriculture, biology, or medicine.

Two fifths of all life scientists are engaged in research and development. Research in the life sciences may take many forms. A botanist exploring the volcanic Alaskan valleys to see when plants live in this strange environment and a zoologist searching the jungles of the Amazon valley for previously unknown kinds of animals are both doing research; likewise, an entomologist in a laboratory tests various chemical insecticides for effectiveness and possible hazards to human and animal life.

Teaching in a college or university is the major function of nearly one-fourth of all life scientists. Many teachers combine independent research with their regular teaching duties.

More than one-fourth of all life scientists are engaged in management and administrative work, primarily the planning, supervision, and administration of programs of research or testing of foods, drugs, and other products. Others provide liaison between the federal government and the agricultural experiment stations at state universities assisting in the planning, development, and evaluation of research programs at these stations.

The remaining life scientists are engaged in a variety of other types of work, such as consulting, writing, testing, and inspection. A few are employed in technical sales or field service work for industrial firms.

Life scientists may be classified into three broad groups characterized by the general type of organism with which they work: botanists, who study plants; zoologists, who are concerned with animals; and microbiologists, who work with microorganisms.

Agronomists are concerned with improving crops and the soil. Those working with the soil analyze it, map the soils of an area, or develop and apply new methods for increasing acreage yields. They also study ways to conserve water and to decrease erosion. Agronomists are concerned with improving crops and the soil. Agronomists involved in crop science develop new methods of growing crops for improved quality, higher yield, and more efficient production. They seek new, hardier varieties of crops and better methods of controlling disease, pests, and weeds.

Anatomists study the form and structure of organisms. Those who specialize in the structure of cells are known as cytologists, whereas those who specialize in the structure of tissues and organs are known as histologists. Many anatomists specialize in human anatomy.

Biological oceanographers, or marine biologists, study the plant and animal life in the oceans and the environmental conditions affecting them.

Biophysicists, who are trained in both physics and biology, investigate the physical principles of living cells and organisms and their responses to physical forces, such as heat, light, radiation, sound, and electricity.

Ecologists study the mutual relationship among organisms and between them and their environment. They are interested in the effects of environmental influences such as rainfall, temperature, and altitude on these organisms.

Embryologists study the development of an organism from fertilization of the egg through the hatching process or gestation period. They investigate the physiological, biochemical, and genetic mechanisms that control and direct the processes of development.

Entomologists are concerned with insects and their relation to plant and animal life. They identify and classify the enormous number of different kinds of insects. Some entomologists seek to control harmful insects through the use of chemicals, predatory birds, or other methods. Others develop ways to encourage the growth and spread of beneficial insects, such as honeybees.

Geneticists explore the origin, transmission, and development of hereditary characteristics. Geneticists engaged primarily in improving plant and animal breeds of economic importance--such as cereal and tobacco crops or dairy cattle and poultry--may be classified as plant or animal breeders, agronomists, or animal science specialists.

Horticulturists work with orchard and garden plants, such as fruits, nuts, vegetables, flowers and ornamental plants, and other nursery stocks. They develop new or improved plant varieties and better methods of growing, harvesting, storing, and transporting horticultural crops.

Husbandry specialists (animal) conduct research on the breeding, feeding, management, and diseases of domestic farm animals to improve the health and yield of these animals.

Nutritionists examine the processes through which food is utilized, the kinds and quantities of food elements--such as minerals, fats, sugars, vitamins, and proteins--that are essential to build and repair body tissues and maintain health, and how these food elements are transformed into body substances and energy. Nutritionists also analyze food to determine its composition in terms of essential ingredients or nutrients.

Pathologists study the nature, cause, and development of disease, degeneration, and abnormal functioning in humans, in animals or in plants. The term "pathologist" is normally reserved for specialists in human pathology (medical pathology). Specialists in animal pathology are usually veterinarians. Those who study plant diseases may be plant pathologists or phytopathologists.

Pharmacologists conduct tests with animals such as rats, guinea pigs, and monkeys to determine the effects of drugs, gases, poisons, dusts, and other substances on the functioning of tissues and organs, and relate their findings with medical data. They may develop new or improved chemical compounds for use in drugs and medicines.

Physiologists study the structure and functions of cells, tissues, and organs and the effects of environmental factors on life processes. They may specialize in cellular activities or in one of the organ systems, such as the digestive, nervous, circulatory, or reproductive systems.

## CHARACTERISTICS OF THE JOB

An estimated 180,000 persons were employed in the life sciences in 1970. About 10 percent were women. Of this total, nearly 48,000 worked in agricultural science, more than 71,000 worked in biological science, and about 61,000 worked on problems related to medical science.

Nearly three-fifths of the total were employed by colleges and universities in teaching and research positions. Medical schools and their associated hospitals employed particularly large numbers of life scientists in the medical field. State agricultural colleges and agricultural experiment stations operated by universities in cooperation with Federal and State Governments employed sizable numbers of agronomists, horticulturists, animal husbandry specialists, entomologists, and other agriculture-related specialists.

## QUALIFICATIONS

Young people seeking professional careers in the life sciences should plan to obtain an advanced degree--preferably a Ph.D.--in their field of interest. The bachelor's degree with a major in one of the life sciences may be adequate preparation for some beginning jobs, but promotional opportunities for those without graduate training are generally limited to intermediate level positions.

The Ph.D. degree generally is required for higher level college teaching positions and for independent research. It is also necessary for many positions involving the administration of research programs.

New graduates having a master's degree may qualify for most entry positions in applied research and for some types of positions in college teaching.

Those having a bachelor's degree may qualify for positions involving testing, production and operation work, technical sales and service, and duties connected with the enforcement of government regulations. They also may obtain positions as advanced technicians, particularly in the medical area. Some graduates having a bachelor's degree may take courses in education and choose a career as a high school teacher of biology rather than one as a life scientist.

Training leading to a bachelor's degree with a major in one of the life science specialities is offered by nearly all colleges and universities. Courses differ greatly from one college to another, and it is important that a student determine which college program best fits his interests and needs.

Prospective life scientists should obtain the broadest undergraduate training possible in all branches of biology and in related sciences, particularly biochemistry, organic and inorganic chemistry, physics, and mathematics. Courses in statistics, calculus, biometrics and computer programming analysis are becoming increasingly essential. Training and practice in laboratory equipment and in fieldwork are also important.

Advanced degrees in the life sciences also are conferred by a large number of colleges and universities. Requirements for advanced degrees usually include fieldwork and laboratory research, as well as classroom studies and preparation of a thesis.

Young people planning careers as life scientists should be able to work independently or as part of a team. The ability to express oneself both orally and in writing is important. Physical stamina and an inquiring mind are necessary for those interested in research in remote places.

EMPLOYMENT PROSPECTS

Employment in the life sciences is expected to increase rapidly through the 1970's. In addition to those needed to fill openings resulting from growth, thousands of life scientists will be needed to replace those who transfer to other fields of work, die, or retire. However, along with the growing number of job openings the number of life science graduates also is projected to increase rapidly. As a result, keen competition is expected for the more desirable positions. Those holding advanced degrees, especially the Ph.D., should experience less competition than bachelor's degree recipients for jobs. Opportunities for those holding only undergraduate degrees will probably be limited to research assistant or technician positions.

OPPORTUNITIES FOR ADVANCEMENT

In the Federal Government in 1970, life scientists having a bachelor's degree could begin at $6,548 or $8,098 a year, depending on their college records. Beginning life scientists having the master's degree could start at $8,098 or $9,881, depending upon their academic records. Those having the Ph.d. degree could begin at $11,905 or $14,192.

Life scientists in colleges and universities earned median salaries between $15,800 and $16,500 a year in 1970, according to the limited information available.

In general, life scientists in private industry tend to have higher salaries than those in either colleges and universities or government employment.

# BIOCHEMIST

## USUAL DUTIES

The biochemist has an important role in modern science's search for the basis of life and the factors that sustain it. His professional interests range from what determines heredity to how living things react to space travel.

Biochemists study the chemical composition of living organisms. They identify and analyze the chemical processes related to biological functions, such as muscular contraction, reproduction, and metabolism. Biochemists investigate the effects on organisms of such chemical substances as foods, hormones, and drugs. They study the chemical changes in living tissue caused by genetic and environmental factors.

Some biochemists combine research with teaching in colleges and universities. Small proportions are engaged in production and testing activities or private counsulting.

## CHARACTERISTICS OF THE JOB

Approximately 11,000 biochemists were employed in the United States in 1970. The number of women in biochemistry is not known. However, almost one-third of all advanced degrees in biochemistry in recent years have been awarded to women. More than half of all biochemists were employed by colleges and universities in 1970. Many of these scientists were teaching and performing research in university-operated laboratories and hospitals. Another 700 biochemists worked for nonprofit organizations, such as research institutes and foundations.

Private industry employed more than one-fifth of all biochemists. The largest group of these worked in the chemical industry primarily for manufacturers of drugs, insecticides, and cosmetics.

## QUALIFICATIONS

The minimum educational requirement for beginning positions in biochemistry is the bachelor's degree with a major in biochemistry or chemistry, or with a major in biology and a minor in chemistry. Graduate training in biochemistry is required for most entrance positions in research and teaching. Graduate work also is needed for advancement to most high-level positions in all types of work.

New graduates having the bachelor's degree usually begin work as research assistants.

Beginning biochemists having advanced degrees usually qualify for research or teaching positions. Some experienced biochemists who have Ph.D. degrees advance to high-level administrative positions and supervise research programs. Other highly qualified biochemists, who prefer to devote their time to research, often become leaders in a particular field of biochemistry.

Young people planning careers as biochemists should be able to work independently or as part of a team. Preciseness, keen powers of observation, and mechanical aptitude also are important. Prospective biochemists should have analytical and curious minds while possessing the patience and perseverance needed to complete hundreds of experiments to solve one problem.

EMPLOYMENT PROSPECTS

The employment outlook is likely to be good for biochemists through the 1970's. In addition to new opportunities resulting from the very rapid growth expected in this field, several hundred will be needed each year to replace workers who transfer to other fields of work, retire, or die.

The greatest demand will be for the biochemist who has the Ph.D. degree to conduct independent research or to teach.

The greatest growth in employment of biochemists is expected in expanding areas of medical research. For instance, the Federal Government is expected to allocate millions of dollars for cancer research during the next few years. Other areas of concentrated medical study include heart disease, muscular dystrophy, and mental illness. Also, an increasing number of biochemists will be needed to work in clinical laboratories associated with hospitals. Additional biochemists will be needed to implement the more stringent drug standards that have been established by Congress and the Federal regulatory agencies. Biochemistry also is becoming important in other fields, such as environmental studies.

OPPORTUNITIES FOR ADVANCEMENT

Starting salaries paid to biochemists employed by colleges and universities are comparable to those for other professional faculty members. Biochemists in educational institutions often supplement their income by engaging in outside research or consulting work.

In 1970, the average (median) earnings for all biochemists who had a bachelor's degree was $10,800; for those having a master's degree, $12,500; and for those having a Ph.D., $15,800.

# CHEMIST

## USUAL DUTIES

The clothes we wear, the food we eat, the houses in which we live--in fact, most of the things which help to make our lives more comfortable, healthy, and productive--have resulted, in part, from the chemist's continuing search for new knowledge. Although the day-to-day activities of chemists generally receive little notice, some of their discoveries have led to the creation of whole new industries, such as the plastics, frozen foods, and manmade fibers industries.

Chemists investigate the properties and composition of matter, and the laws that govern the combination of elements in a seemingly endless variety of forms. They search for new knowledge about substances and try to utilize this knowledge for practical use.

Nearly two-fifths of all chemists are engaged in research and development. Many research chemists work on applied research projects to create new products or improve or find new uses for existing ones. Chemists in applied research have helped to develop a vast range of new products including antibiotics, plastics, synthetic rubbers, detergents, insecticides, and manmade fibers. Many other chemists work on basic research to extend scientific knowledge rather than to solve immediate practical problems. Results of basic research frequently apply immediately to practical problems.

More than one-fourth of all chemists are employed in management and administration--especially research and development activities. Approximately one-tenth of all chemists devote most of their time to teaching, often combining it with research. Analysis and testing is another major activity of chemists because various kinds of tests must be made at practically every stage in the manufacture of a product, from initial development to final production. Nearly one-fifth of all chemists are engaged in production and inspection activities which may insure, for instance, the quality of final products or the improvement of products and processes.

## CHARACTERISTICS OF THE JOB

Chemistry is by far the largest field of employment in the physical sciences. Nearly 137,000 chemists were employed in the United States in 1970; about seven percent were women.

Approximately three-fourths of all chemists were employed by private industry in 1970.

Colleges and universities employed more than 25,000 chemists. A smaller number worked for non-profit research organizations. A number of chemists were employed by federal government agencies and local governments, primarily in agencies concerned with health or agriculture.

Chemists were employed in all states, in small as well as large cities. However, they were usually concentrated in large industrial areas. Nearly one-fifth of all chemists were located in four metropolitan areas--New York, Chicago, Philadelphia, and Newark. About half of the total worked in six states--New York, New Jersey, California, Pennsylvania, Ohio, and Illinois.

QUALIFICATIONS

A bachelor's degree with a major in chemistry is usually the minimum educational requirement for starting a career as a chemist. Graduate training is essential for many positions, particularly in research and college teaching, and is helpful for advancement in all types of work.

Training leading to the bachelor's degree in chemistry is offered by about 1,000 colleges and universities throughout the country. In addition to the required chemistry courses in analytical, inorganic, organic, and physical chemistry, the undergraduate chemistry major also takes courses in mathematics (especially analytical geometry and calculus) and physics.

Advanced degrees in chemistry are awarded by 300 colleges and universities, many of which offer financial assistance to students interested in graduate study. In graduate school, the student usually specializes by taking several courses in a particular field of chemistry.

New graduates having the bachelor's degree usually qualify for beginning positions in analysis and testing, quality control, technical service and sales, or assist senior chemists in research and development work. Most chemists having only the bachelor's degree start their careers in industry or government. In industry, employers often have special training programs for new chemistry graduates. Some chemists who have the bachelor's degree teach or do research in colleges and universities while working toward advanced degrees. They also may qualify as secondary school teachers.

Chemists having the master's degree often qualify for applied research positions in government or private industry. They also may qualify for some teaching positions in colleges and universities and in two-year colleges.

The Ph.D. degree generally is required for basic research, for higher level faculty positions in a college or university, or for advancement to top-level positions in administration and in other activities.

Students planning careers as chemists should enjoy studying science and mathematics and working with their hands to build scientific apparatus and perform experiments. Perseverance and the ability to concentrate on detail and work independently are essential to the prospective chemist. Other desirable assets include an inquisitive mind, good memory, and imagination. The ability to write is important in preparing reports on experiments. Chemists also should have good eye-hand coordination and eyesight.

EMPLOYMENT PROSPECTS

The employment outlook for chemists is expected to be favorable through the 1970's. In addition to new opportunities resulting from the rapid growth expected in the profession, thousands of new chemists will be needed each year to replace those who retire, die, or transfer to other occupations.

Chemists will continue to be needed to perform research and development work. Through the 1970's, research and development (R&D) expenditures of government and industry are expected to increase, although at a slower rate than during the 1960's.

Another factor increasing the opportunities for chemists is the growing demand for industrial products. These include plastics, manmade fibers, drugs, fertilizers, and high energy and nuclear fuels for missiles and space ships.

Chemists also will be required to teach at colleges and universities through the 1970's to accommodate larger enrollments expected at these institutions. The greatest demand in colleges and universities will be for those who have Ph.D. degrees, but many openings, especially in two-year colleges, also should arise for chemists who have master's degrees. (See statement on College and University Teachers.)

New graduates also will find openings in high school teaching, provided they have completed the professional education courses and other requirements for a state teaching certificate. However, they usually are regarded as teachers rather than as chemists.

OPPORTUNITIES FOR ADVANCEMENT

Inexperienced chemistry graduates having a bachelor's degree had an average (median) starting salary of about $9,400 a year in private industry in 1970, according to a survey conducted by the American Chemical Society. Inexperienced graduates having the master's degree averaged about $11,000 a year and those having the Ph.D. degree, about $15,000.

In academic institutions, the average (median) annual starting salary for the few entrants having the bachelors degree and no experience was about $6,600, according to the American Chemical Society. The average salary for inexperienced graduates having the master's degree was about $8,000, and for those having the Ph.D. degree, $11,200.

Chemists spend most of their time working in modern, well-equipped, well-lighted laboratories, offices, or classrooms. Chemists work with chemicals that can be dangerous if handled carelessly. However, when safety regulations are followed, health hazards are negligible.

# RADIOLOGIC TECHNOLOGIST

## USUAL DUTIES

Medical X-rays play a major role in the diagnostic and therapeutic fields of medicine. Radiologic technologists, also called medical X-ray technicians, operate X-ray equipment under the direction of physicians who are usually radiologists (specialists in the use of X-rays).

Most radiologic technologists perform diagnostic work, using X-ray equipment to take pictures of internal parts of the patient's body. They may prepare chemical mixtures, such as barium salts, which the patient swallows to make specific organs appear clearly in X-ray examinations.

Some radiologic technologists perform radiation therapeutic work. They assist physicians in treating diseases, such as certain cancers, by administering prescribed doses of X-ray or other forms of ionizing radiation to the affected areas of the patient's body. They also may assist the radiologist in measuring and handling radium and other radioactive materials.

## CHARACTERISTICS OF THE JOB

An estimated 80,000 radiologic technologists were employed in 1970; about two-thirds were women.

Approximately one-third of all radiologic technologists were employed in hospitals; most of the remainder worked in medical laboratories, physicians' and dentists' offices or clinics, federal and state health agencies, and public school systems. A few worked as members of mobile X-ray teams, engaged mainly in tuberculosis detection.

## QUALIFICATIONS

Training programs in X-ray technology are conducted by hospitals or by medical schools affiliated with hospitals. A program in X-ray technology usually takes 24 months to complete. A few schools offer three or four year programs, and eleven schools award a bachelor's degree in X-ray technology. Also, some junior colleges coordinate academic training with work experience in hospitals in three year X-ray technician programs and offer an Associate of Arts degree. In addition to training programs in approved schools, training also may be obtained in the military service. Some courses in X-ray technology are offered by vocational or technical schools.

All of the approved schools accept only high school graduates, and a few require one or two years of college or graduation from a nursing school. High school courses in mathematics, physics, chemistry, biology, and typing are desirable.

X-ray technology programs usually include courses in anatomy, physiology, nursing procedures, physics, radiation protection, darkroom chemistry, principles of radiographic exposure, X-ray therapy, radiographic positioning, medical ethics, department administration, and the operation and maintenance of equipment.

Registration with the American Registry of Radiologic Technologists is an asset in obtaining highly skilled and specialized positions. Registration requirements include graduation from an approved school of medical X-ray technology and the satisfactory completion of an examination.

As openings occur, some technicians in large X-ray departments may advance to chief X-ray technician and qualify as instructors in X-ray techniques.

Good health and stamina are important qualifications for this field.

EMPLOYMENT PROSPECTS

Employment opportunities for radiologic technologists are expected to be very good through the 1970's. Part-time opportunities also will be very favorable.

Very rapid growth is expected in the profession, primarily as a result of the anticipated expansion in the use of X-ray equipment in diagnosing and treating diseases; more workers also will be needed to help administer radiotherapy as new knowledge of the medical benefits of radioactive material becomes widespread.

In addition to the radiologic technologists needed for new jobs, replacement demands are expected to be high because of the large number of women who leave their jobs each year for marriage or family responsibilities.

OPPORTUNITIES FOR ADVANCEMENT

Beginning salaries of radiologic technologists employed in hospitals ranged from about $110 to $190 a week in 1970, according to the limited information available.

New graduates of AMA-approved schools of X-ray technology employed by the federal government received an annual salary of $5,853 in 1970.

Full-time technicians generally work 8 hours a day and 40 hours a week but may be "on call" for some night or emergency duty. Most are covered by the same vacation and sick leave provisions as other workers in the same organization.

Precautionary measures to protect radiologic technologists from the potential hazards of radiation exposure include the use of safety devices such as individual instruments that measure radiation, lead aprons, leaded gloves, and other shielding.

## OCCUPATIONS IN ATOMIC ENERGY

A brief description of some important atomic energy activities and the type of workers employed in them follows.

Uranium Exploration and Mining. The 6,500 persons employed in uranium exploration and mining in 1970 had jobs similar to those in the mining of other metallic ores. Their jobs are largely concentrated in the Colorado Plateau area of the Far West, in the states of New Mexico, Wyoming, Utah, Colorado, and Arizona. Most workers in uranium mines are in production jobs, such as miner and driller in underground mines; and as truck driver, bulldozer operator, and machine loader in open pit mines.

Uranium Ore Milling. In uranium mills, metallurgical and chemical processes are used to extract uranium from mined ore.

These mills employ skilled machinery repairmen, millwrights, pipefitters, carpenters, electricians, chemical process operators, scientists, and engineers.

Uranium Refining and Enriching. Milled uranium is chemically processed to remove impurities and then converted to metal or intermediate chemical products for reactor fuel preparation. Conventional chemical and metallurgical processes are used, but they must meet more exacting standards than in most other industries.

Activity in this segment of the atomic energy field is centered in Ohio, Tennessee, Kentucky, and Illinois.

Maintenance craftsmen, particularly in the highly automated uranium enriching plants, account for a large proportion of skilled workers. Large numbers of chemical process operators also are employed. Chemical engineers and chemists accounted for more than a third of the engineers and scientists.

Reactor Manufacturing. About 22,500 workers were employed in 1970 to design and manufacture nuclear reactors and unique reactor parts. Reactor manufacturers do extensive development work on reactors and auxiliary equipment, design the reactor, and generally fabricate some of the intricate components, such as fuel elements, control rods, and reactor cores.

Skilled workers are employed by reactor manufacturers in experimental, production, and maintenance work. All-round machinists account for a large proportion of these craftsmen.

Reactor Operation and Maintenance. Almost 2,300 workers operated and maintained nuclear reactors producing commercial electricity in 1970. Some of the occupations found in the operation of a nuclear power station are mechanical engineer, electrical and electronics engineer, instrument technician, electronics technician, radiation monitor, reactor operator, and other power plant operators and attendants.

Research and Development Facilities. A number of research and development laboratories and other research facilities are owned by the Atomic Energy Commission and are operated for the AEC by universities and industrial concerns. These facilities are major centers for basic and applied nuclear research in the physical, engineering, and life sciences and in the development of nuclear reactors and other nuclear equipment. More than half of the employees in AEC research and development facilities are engineers, scientists, and supporting technicians. Assisting scientists and engineers are many physical science and engineering aids; draftsmen; electronics, instrument, and biological technicians; and radiation monitors.

Administrative and clerical workers together account for a large proportion of employment. The skilled worker group includes large numbers of all-round machinists, electricians, machinery repairmen, and millwrights, as well as substantial numbers of tool and die makers, instrument makers, and pipefitters. Nuclear reactor operators are employed to operate research and test reactors and many service workers are employed in plant protection and security operations.

Production of Nuclear Weapons and Other Defense Materials. More than 31,000 workers were employed in 1970 in establishments producing nuclear weapons and weapon components, plutonium, and other defense materials. The skilled workers in this industry include large numbers of machinery repairmen and millwrights, chemical process operators, all-round machinists, electricians, instrument repairmen, pipefitters, tool and die makers, and instrument makers.

Among the large number of scientists and engineers employed at these facilities are many chemists, physicists, and mechanical, chemical, and electrical and electronics engineers. Many engineering and physical science aides, draftsmen, radiation monitors, and electronics technicians are employed to assist scientists and engineers.

Other Atomic Energy Activities. Nearly 1,700 workers were employed in 1970 to produce special materials such as beryllium, zirconium, and hafnium for use in reactors.

More than 6,500 workers were employed by companies that manufacture reactor control instruments, radiation detection and monitoring devices, and other instruments for the atomic energy field. Engineers and technicians represent a substantial proportion of employment in this field.

More than 700 persons were employed in companies which specialize in the manufacture of particle accelerators or their specialized components.

Other workers in the atomic energy field are engaged in activities such as processing and packaging radioisotopes, manufacturing radiography units and radiation gauges, packaging and disposing of radioactive wastes, and industrial radiography.

Government Employment. The Atomic Energy Commission, which directs the federal government's atomic energy program, employed more than 7,300 workers in its headquarters and field offices in 1970. Nearly 9 out of 10 Commission employees are in administrative and other professional positions or in clerical jobs.

Health Physicists (sometimes called radiation or radiological physicists or chemists) are responsible for detecting radiation and applying safety standards to control exposure to it.

In some cases, they are employed on research projects dealing with the effects of human exposure to radiation and may develop procedures to be followed in using radioactive materials.

Radiation monitors (also called health-physics technicians) generally work under the supervision of health physicists. They use special instruments to monitor work areas and equipment to detect radioactive contamination.

Nuclear reactor operators perform work in nuclear power stations similar to that of boiler operators in conventional power stations; however, the controls operated are different. In addition, reactor operators may assist in the loading and unloading of reactor cores.

Accelerator operators set up and coordinate the operation of particle accelerators. They adjust machine controls to accelerate electrically charged particles, in accordance with instructions from the scientist in charge of the experiment, and set up target materials which are to be bombarded by the accelerated particles. They also may assist in the maintenance of equipment.

Radiographers take radiographs of metal castings, welds, and other objects by adjusting the controls of an X-ray machine or by exposing a source of radioactivity to the object to be radiographed. They select the proper type of radiation source and film to use and apply standard mathematical formulas to determine exposure distance and time.

Hot-cell technicians operate remote-controlled equipment to test radioactive materials that are placed in hot cells--rooms that are enclosed with radiation shielding materials, such as lead and concrete. By controlling "slave manipulators" (mechanical devices that act as a pair of arms and hands) from outside the cell and observing their actions through the cell window, these technicians perform standard chemical and metallurgical operations with radioactive materials. Hot-cell technicians also may enter the cell wearing protective clothing to set up experiments or to decontaminate the cell and equipment. Decontamination men have the primary duty of decontaminating equipment, plant areas, and materials exposed to radioactive contaminants. Waste-treatment operators operate heat exchange units, pumps, compressors, and other equipment to decontaminate and dispose of radioactive waste liquids. Waste-disposal men seal contaminated wastes in concrete containers and transport the containers to a burial ground.

Radioisotope-production operators use remote control manipulators and other equipment to prepare radioisotopes for shipping and to perform chemical analyses to ensure that radioisotopes conform to specifications.

QUALIFICATIONS

Training and educational requirements and advancement opportunities for most workers in atomic energy activities are generally similar to those for comparable jobs in other fields. However, specialized training is required for many workers because the atomic energy field is relatively new, requires rigorous work standards in both its research and production activities, and has unique health and safety problems.

Engineers and scientists at all levels of professional training are employed in the atomic energy field. Of the scientists and engineers employed in research and development by major AEC contractors, about one-fourth have a Ph.D. degree.

Specialized knowledge of nuclear energy, which is essential for most scientific and engineering positions in atomic energy, may be obtained at a university or sometimes on the job.

Engineers and scientists who plan to specialize in the atomic energy field generally take graduate work in nuclear energy, although introductory or background courses may be taken at the undergraduate level.

Craftsmen in some atomic energy jobs need more training than most craftsmen in comparable nonatomic jobs because of the extreme precision required. Craftsmen in atomic energy generally obtain the required special skills on the job. Many AEC installations also have apprentice training programs to develop craft skills.

Health physicists should have at least a bachelor's degree in physics, chemistry, or engineering, and a year or more of graduate work in health physics.

A radiation monitor can qualify for on-the-job training with a high school education with courses in mathematics, physics, and chemistry.

Nuclear power reactor operators need a basic understanding of reactor theory and a working knowledge of reactor controls. Most operator trainees have a high school education. Preference sometimes is given to those who have completed courses in science and engineering at the college level. Workers who operate the controls of private nuclear reactors must be licensed by the AEC.

An accelerator operator usually requires a high school education that includes courses in mathematics and physics to qualify for on-the-job training. Accelerator operators receive several months of on-the-job training.

Hot-cell technicians and decontamination men may be high school graduates with some mechanical experience who can qualify for on-the-job training. They may be given in-plant training lasting several months. Radioisotope-production operators usually require a high school education with courses in chemistry. High school graduates can qualify as waste-treatment operators, but experience in reading electronic instruments or in a chemical laboratory is desirable. High school graduates also can qualify for employment as waste-disposal men.

Individuals who handle classified data (restricted for reasons of national security) or who work on classified projects in the atomic energy field must have a security clearance based on an investigation of a person's character, loyalty, and associations.

The Atomic Energy Commission, at its contractor-operated facilities, supports on-the-job and specialized training programs to help prepare scientists, engineers, technicians, and other workers for the atomic energy field. The AEC also offers graduate fellowships in specialized nuclear fields.

More than 600 fellowships were awarded for the 1969-70 academic year. In addition, other federal agencies also gave a number of fellowships for graduate work in nuclear science and technology. The prerequisite for consideration for a fellowship is a bachelor's degree in engineering or physical science.

Many Commission contractors provide employees with training at their own plants or at nearby colleges and universities.

## EMPLOYMENT PROSPECTS

Total employment in the atomic energy field is expected to increase moderately during the 1970's as commercial activities in atomic energy expand, and as new applications of this energy form are developed.

## OPPORTUNITIES FOR ADVANCEMENT

In 1970, blue-collar workers employed by contractors at AEC laboratories and other installations had average straight-time hourly earnings of $4.11; blue-collar workers in all manufacturing industries had average earnings of $3.36 an hour.

Professional workers employed at AEC installations averaged $15,000 a year in base pay in 1970, and other white-collar workers (largely clerical and other office personnel) averaged nearly $7,300 a year.

Working conditions in uranium mining and milling, instrument and auxiliary equipment manufacturing, and facilities construction are generally similar to those in comparable nonatomic energy activities, except for radiation safety precautions. All uranium mines are equipped with mechanical ventilation systems that reduce the concentration of radioactive radon gas--a substance that can cause lung injury if inhaled over a number of years. Efforts to eliminate this hazard are continuing. Only a small proportion of employees in the atomic energy field actually work in areas where direct radiation hazard dangers exist. Even in these areas, shielding, automatic alarm systems, and other devices and clothing give ample protection to the workers. In some cases, plants are located in remote areas.

Extensive safeguards and operating practices ensure the health and safety of workers, and the AEC and its contractors have maintained an excellent safety record. The AEC regulates the possession and use of radioactive materials, and AEC personnel inspect nuclear facilities to insure compliance with the AEC's health and safety requirements. Constant efforts are being made to provide better safety standards and regulations.

# FISH

FISH HATCHERY WORKER

FISHERIES TECHNICIAN

FISHERIES SCIENTIST

# FISH HATCHERY WORKER

## USUAL DUTIES

The Fish Hatchery Worker, under the direction of a Fisheries Scientist, cares for the fish while they are at the hatchery until they are released in a pond, lake, or stream.

One of the main jobs of the Fish Hatchers Worker is the preparation of the hatchery tanks for spawning. This includes cleaning the tanks by draining out the water, removing the muck and debris, and scrubbing the tank. Other duties involve overseeing the treatment of the spawn, caring for and feeding small fish, regulating the temperature of the indoor tanks, and sorting the fish according to size, color, and species. When the fish grow large enough, the Fish Hatchery Worker transfers them to outside tanks.

The Fish Hatchery Worker operates and maintains hatchery equipment and facilities. This includes the pumps, seines, aerators, mowers, trucks, ponds, tanks, dams, and raceways.

The Fish Hatchery Worker counts and sorts fish species to be delivered to farm ponds, lakes, streams, or rivers. This individual also loads and transports the fish to designated sites and then releases them.

## CHARACTERISTICS OF THE JOB

Work is relatively steady throughout the year, but may vary somewhat according to the season. Work is performed both indoors and outdoors. There is usually a fishy odor around the hatchery but a worker soon becomes used to it.

## QUALIFICATIONS

A high school education is preferred. A deep interest in fish, wildlife, and outdoor living is desirable. Such courses as mathematics, biology, chemistry, general science, English, and agriculture may be helpful.

A worker may have to pass a civil service examination if employment is sought with a state or federal fish and wildlife agency. Part-time summer employment will provide valuable experience and later may lead to full time employment.

## EMPLOYMENT PROSPECTS

Prospects look fairly good for the future. The increasing popularity of recreational fishing will result in an increased demand for individuals in this field.

OPPORTUNITIES FOR ADVANCEMENT

The Fish Hatchery Worker may advance to the position of Fish Hatchery Manager after several years of satisfactory work performance. Further education may be necessary for this advancement.

# FISHERIES TECHNICIAN

## USUAL DUTIES

The Fisheries Technician assist the Fisheries Scientist in fish studies and management. These studies include fish nutrition, behavior, and reproduction. Fisheries technician personnel capture fish for studies, marking, and transfer from one area to another, and record information such as age, size, and stomach contents of fish. Daily and seasonal movements and feeding habits of fish populations are also studied.

The Fisheries Technician assists in the management of fish and shell fish populations by collecting and organizing fisheries resource data and preparing reports of findings for the Fisheries Scientist.

## CHARACTERISTICS OF THE JOB

Work is steady throughout the year. The work week varies according to the seasonal work being done. Work usually is outdoors in all climatic conditions.

## QUALIFICATIONS

A Fisheries Technician should have an associate degree in fish management or a related field, or the equivalent in work experience. This individual must be able to write reports and interpret field notes. Because most work is outdoors and may require carrying equipment, good physical condition is a requirement.

The applicant may have to pass a civil service entrance examination if employment is sought with a state or federal agency. Part-time summer employment will provide valuable experience and later may lead to full-time employment.

## EMPLOYMENT PROSPECTS

Employment prospects are good for the future. Opportunities for employment exist in federal and state government agencies, educational institutions, and private organizations and industries.

Some federal agencies that employ technicians are: Bureau of Commercial Fisheries, Bureau of Sport Fisheries and Wildlife, Army Corps of Engineers, Bureau of Outdoor Recreation, Forest Service, National Park Service, Public Health Service, Soil Conservation Service, and the Environmental Protection Agency.

State governments are the largest employers of Fisheries Technicians. These positions are located in state conservation agencies such as the Department of Natural Resources, Department of Fish and Game, Department of Environmental Resources, Department of Parks and Recreation, and Department of Agriculture.

OPPORTUNITIES FOR ADVANCEMENT

The Fisheries Technician may advance to the position of Fisheries Scientist after several years of satisfactory work performance and further education.

# FISHERIES SCIENTIST

## USUAL DUTIES

The Fisheries Scientist studies fish and their habitat. When changes in fish growth rates and population are noted, this individual uses scientific methods to determine reasons for the changes.

The Fisheries Scientist looks for ways to improve fishing. By studying fishing pressure and fish harvests, the scientist tries to determine if more fish should be stocked in certain areas. Effects of stream pollution on age, growth, and feeding habits of various fish species are also studied.

The Fisheries Scientist collects, identifies, and preserves fish specimens. Other duties include the preparation of reports and articles for books and magazines, and presenting educational programs to interested groups. This individual may assist in enforcing laws during peak periods of sports activity.

## CHARACTERISTICS OF THE JOB

Work is steady throughout the year with a 40-hour work week. However, the Fisheries Scientist may conduct studies which require irregular working hours. Work is mostly outdoors.

## QUALIFICATIONS

A Fisheries Scientist needs a college degree in fisheries management, biological science, forestry, or a related field.

An individual in this field must enjoy working outdoors. Skills are necessary in handling fishing equipment--nets, fishing tackle, boats and boating equipment--and the scientific equipment now being used, such as fish shockers.

## EMPLOYMENT PROSPECTS

Employment prospects for Fisheries Scientists are expected to be good and increase in the future. The increasing interest in fishing and the development of environmental programs will require additional personnel in this field.

## OPPORTUNITIES FOR ADVANCEMENT

The Fisheries Scientist may advance to positions of greater responsibility after a year or more of satisfactory work performance. This may involve lake or stream management or conducting research experiments.

# HEALTH

SANITARIAN

VETERINARIAN

MEDICAL LABORATORY WORKER

LICENSED PRACTICAL NURSE

MEDICAL ASSISTANT

# SANITARIAN

## USUAL DUTIES

Sanitarians are specialists in environmental health. To assure the cleanliness and safety of the food people eat, the liquids they drink, and the air they breathe, sanitarians perform a broad range of duties. They inspect food manufacturing and processing plants, dairies, water supplies, hotels and restaurants, nursing homes, hospitals and schools, waste disposal plants, swimming pools and other recreation facilities, housing, and other places for health hazards. They also plan and conduct sanitation programs, administer environmental health programs, and promote the enactment of health regulations and laws.

Sanitarians entering the profession usually begin in public health or agriculture departments or private industry. They inspect facilities and may collect samples of food, air, and water to test for safety. When necessary, they recommend corrective action according to health laws and regulations.

Sanitarians having supervisory duties analyze reports of inspections and investigations made by other environmental health specialists, and advise on difficult or unusual sanitation problems. They also may conduct investigations and give evidence in court cases involving public health regulations. In addition, they promote health laws and engage in health education activities.

Public health sanitarians work closely with other health specialists in the community (such as the health officer, sanitary engineer, and public health nurse) to investigate and prevent outbreaks of disease, plan for civil defense and emergency disaster aid, make public health surveys, and conduct health education programs.

Increasing numbers of sanitarians are being employed outside government agencies. Many work in industry to prevent or minimize contamination hazards and see that clean, healthful, and safe working conditions exist.

## QUALIFICATIONS

A bachelor's degree in environmental health is the preferred preparation for a beginning job as a professional sanitarian, although a bachelor's degree in a basic science generally is acceptable. High level positions usually require a graduate degree in some aspect of public health. In some cases, sanitarian technicians having two years of college and work experience can advance to professional sanitarian positions. However, as hiring standards are raised, it will become harder for persons without a degree to enter the profession.

A typical curriculum leading to a bachelor of science degree in environmental health includes background courses in the humanities, social sciences, mathematics, chemistry, physics and biology. Core courses include microbiology (environmental), biostatistics, epidemiology, community health education, public health organization and administration, environmental health, and field work.

Beginning sanitarians usually start at the trainee level, where they remain up to a year, working under the supervision of experienced sanitarians. They receive on-the-job training in environmental health practice and learn to evaluate conditions and recommend corrective action. After a few years of experience, they may be promoted to minor supervisory positions with more responsibilities. Further advancement is possible to top supervisory and administrative positions.

In 1970, 35 states had laws providing for registration of sanitarians; in some states, registration is required to practice. Although requirements for registration vary considerably among the states, the minimum educational requirement usually is a bachelor's degree, with emphasis on the biological, physical, and sanitary sciences.

Among the personal qualities useful to sanitarians is the ability to communicate effectively, since it is necessary to write detailed reports and to deal with persons tactfully concerning the correction of unsanitary conditions. A mechanical aptitude also is helpful, since sanitarians may operate various testing devices.

## EMPLOYMENT PROSPECTS

Employment of sanitarians is expected to increase very rapidly through the 1970's, as state and local health agencies expand their activities in the field of environmental health. Radiological health, occupational health, food protection, solid waste management, and water and air pollution are expected to require the services of more trained personnel as health dangers grow under the stimulus of an expanding, highly technological society.

Air pollution is one example of an existing environmental hazard that has attracted widespread public concern. Legislation which regulates the quantity of sulfates or other chemical compounds that can be emitted into the air will increase the demand for professional sanitarians.

## OPPORTUNITIES FOR ADVANCEMENT

Beginning sanitarians having a college degree usually earned from $7,000 to $7,500 in 1970, according to the National Environmental Health Association. Salaries of experienced professional sanitarians generally ranged from $10,000 to $14,000 a year; environmental health directors often earned from $14,000 to $30,000. Sanitary aides and technicians without a college degree generally earned from $5,000 to $8,000 in 1970.

Professional sanitarians employed in the federal government began at $6,548 or $8,092 in 1970, depending on their academic records. Experienced sanitarians in the federal service generally earned from $9,881 to $14,192.

# VETERINARIAN

## USUAL DUTIES

Veterinarians (doctors of veterinary medicine) diagnose, treat, and control numerous diseases and injuries among animals. Their work is important for the Nation's food production and for public health. Veterinarians perform surgery on sick and injured animals, and prescribe and administer drugs, medicines, serums, and vaccines.

Their work is vital to public health because it helps to prevent the outbreak and spread of diseases among animals. Many of these diseases can be transmitted to human beings.

Veterinarians treat animals in veterinary hospitals and clinics, or on the farm and ranch. In addition, veterinarians give advice on the care and breeding of animals.

The majority of veterinarians are general practitioners. Of those who are specialists, the greatest number treat small animals or pets. Some specialize in the health care of cattle, poultry, sheep, swine, or horses. Many veterinarians inspect meat, poultry, and other foods as a part of federal and state public health programs. Still others serve on faculties of veterinary colleges. Some do research related to animal diseases, foods, and drugs, or may act as part of a medical research team, to seek knowledge about prevention and treatment of human diseases.

## CHARACTERISTICS OF THE JOB

About 25,000 veterinarians were working in 1970; only 2 percent were women. Almost two-thirds of all veterinarians were in private practice. In addition, many worked for state and local government agencies and a few worked for international health agencies. Some were employed by colleges of veterinary medicine, agricultural colleges, medical schools, research and development laboratories, large livestock farms, animal food companies, and pharmaceutical companies manufacturing drugs for animals.

## QUALIFICATIONS

A license is required to practice veterinary medicine in all states and the District of Columbia. To obtain a license, an applicant must have the degree of Doctor of Veterinary Medicine (D.V.M. or V.M.D.) awarded upon graduation from a veterinary school approved by the American Veterinary Medical Association. He also must pass a State Board examination, and, in a few states, have some practical experience under the supervision of a licensed veterinarian. A limited number of states issue licenses without further examination to veterinarians already licensed by another state.

For positions in research or teaching, an additional master's or Ph.D. degree is usually required in a field such as pathology, physiology, or bacteriology.

Minimum requirements for the D.V.M. or V.M.D. degree are two years of preveterinary college work followed by four years of study in a college of veterinary medicine. However, most candidates complete three or four years of a preveterinary curriculum (emphasizing the physical and biological sciences). Veterinary college training includes considerable practical experience diagnosing and treating animal diseases and performing surgery and laboratory work in anatomy, biochemistry, and other scientific and medical subjects.

There were 18 colleges of veterinary medicine in the United States in 1970. Some of the qualifications considered by these colleges in selecting students were scholastic record, amount and character of preveterinary training, health, and an understanding and affection for animals.

Some veterinarians begin as assistants to, or partners of, established practitioners. Many start their own practice with a modest financial investment in drugs, instruments, and an automobile. A more substantial financial investment is required to open an animal hospital or purchase an established practice. Newly qualified veterinarians may enter the Army and Air Force as commissioned officers, or qualify for federal positions as meat and poultry inspectors, disease-control workers, epidemiologists, or research assistants.

Veterinarians should have physical strength and courage to handle animals who may become aggressive because of pain or injury. They should be able to work independently and keep abreast of the advances in the profession.

EMPLOYMENT PROSPECTS

Veterinarians are expected to have good employment opportunities through the 1970's. Although an increase in the demand for their services is anticipated, the number of veterinarians will be restricted by the limited capacity of schools. However, some expansion in veterinary school facilities is expected because of the passage of the Veterinary Medical Education Act of 1966.

OPPORTUNITIES FOR ADVANCEMENT

Veterinarians beginning their own practice generally can cover their expenses the first year and often add to their earnings by working part time for government agencies. As they gain experience, their incomes usually increase substantially.

Newly graduated veterinarians without experience earned $10,539 in the federal government in 1970. Those who had demonstrated superior ability in their studies started at $11,905. Summer trainees in the U.S. Department of Agriculture received $155 each week they worked (representing a rate of $8,098 a year) in 1970. Experienced veterinarians working for the federal government generally earned between $13,500 and $26,700 a year. The income of veterinarians in private practice usually is higher than that of other veterinarians according to the limited data available.

Veterinarians sometimes may be exposed to danger of physical injury, disease, and infection. Those in private practice are likely to have long and irregular hours. Veterinarians in rural areas may have to spend much time traveling to and from farms and may have to work outdoors in all kinds of weather. Veterinarians can continue working well beyond normal retirement age because of many opportunities for part-time work.

# MEDICAL LABORATORY WORKER

## USUAL DUTIES

Laboratory tests play an important part in the detection, diagnosis, and treatment of cancer, tuberculosis, diabetes, meningitis, and other diseases. Medical laboratory workers, often called clinical laboratory workers, include three levels: medical technologists, technicians, and assistants. They perform tests under the direction of pathologists (physicians who specialize in diagnosing the causes and nature of disease), other physicians or scientists specializing in clinical chemistry, microbiology, or the other biological sciences. Medical laboratory workers use precision instruments, such as microscopes and automatic analyzers, to analyze the blood, tissues, and fluids in the human body. Results of such tests help physicians treat patients.

Medical technologists, who require four years of post-secondary training, perform the more complicated chemical, microscopic, and bacteriological tests. Other body fluids may be examined microscopically; cultured to determine the presence of bacteria, parasites, or other microorganisms; and analyzed for chemical content or reaction. Technologists also may type and cross-match blood samples.

Medical laboratory assistants, who generally do not have college training, assist the medical technologist in routine tests and related work that can be learned in a relatively short time.

In addition to performing routine tests, assistants may store and label plasma; clean and sterilize laboratory equipment, glassware, and instruments; prepare solutions following standard laboratory formulas and procedures; keep records of tests; and identify specimens.

Medical laboratory technicians generally have a higher level of skill than assistants, but not the technical knowledge of highly-trained technologists. Like technologists and assistants, they may work in several areas or specialize in one field.

## CHARACTERISTICS OF THE JOB

An estimated 110,000 medical laboratory workers were employed in 1970--two-fifths were medical technologists. Approximately 80 to 90 percent of all medical laboratory workers were women. However, the number of men in the field has been increasing in recent years.

About four-fifths of all medical laboratory workers are employed in hospitals. Other places of employment include independent laboratories, physicians' offices, clinics, public health agencies, pharmaceutical firms, and research institutions.

QUALIFICATIONS

The usual minimum educational requirement for beginning medical technologists is four years of college including completion of a specialized training program in medical technology approved by the American Medical Association.

Undergraduate work must include courses in chemistry, biological science, and mathematics. The specialized training usually requires twelve months of study and includes extensive laboratory work. In 1970, such training was given in about 800 hospitals and schools, most of which were affiliated with colleges and universities. A bachelor's degree is often awarded upon completion of the college affiliated program. A few schools require a bachelor's degree for entry into the program.

Many universities also offer advanced degrees in medical technology and related subjects for technologists who plan to specialize in the laboratory or in teaching, administration, or research.

Most medical laboratory assistants employed in 1970 received their training on the job. In recent years, however, an increasing number have received their training in academic programs conducted by hospitals or vocational schools and junior colleges in cooperation with hospitals. In the future, academic training probably will be required by most employers. Hospitals offer the greatest number of training programs. For entry into these programs, graduation from high school with courses in science and mathematics is generally required. The programs last a year and include classroom instruction and practical training in the laboratory. These programs often begin with a general orientation to the clinical laboratory and are followed by courses in bacteriology, serology, parasitology, hematology, clinical chemistry, blood banking, and urinalysis.

Certification examinations, administered by the Board of Medical Technologists of the American Society of Clinical Pathologists (ASCP) are available to graduates of AMA approved schools. Such registration is important because it indicates that a graduate has maintained educational standards recognized by the medical profession. ASCP-registered medical laboratory personnel are preferred by most employers.

In California, Florida, Hawaii, Tennessee, New York City, and Puerto Rico, medical technologists and technicians also must be licensed.

Technologists may be promoted to supervisory positions in certain areas of laboratory work or, after several years' experience, to chief medical technologist in a large hospital. Graduate education in one of the biological sciences or chemistry usually speeds advancement in all areas. Technicians and assistants may have difficulty advancing to medical technologists unless they continue their education and obtain a bachelor's degree in biology or chemistry, or a degree or certificate in medical technology.

Personal characteristics important for medical laboratory work include accuracy, dependability, and the ability to work under pressure. Manual dexterity and the ability to discriminate colors accurately are highly desirable.

## EMPLOYMENT PROSPECTS

Employment opportunities for medical laboratory workers are expected to be excellent through the 1970's. New graduates having a bachelor's degree in medical technology will be sought for entry technologist positions in hospitals. A particularly strong demand is anticipated for technologists having graduate training in biochemistry, micro-biology, immunology, and virology. Employment opportunities for medical laboratory technicians and assistants also are expected to be very favorable.

## OPPORTUNITIES FOR ADVANCEMENT

Salaries of medical laboratory workers vary by employer and geographic location of employment. In general, medical laboratory workers employed on the West Coast and in large cities received the highest salaries.

The average starting salary for medical technologists was about $7,500 in 1970, according to limited data available. Beginning salaries for medical laboratory assistants generally ranged from $150 to $250 a month less than those paid medical technologists. Technicians received salaries ranging between those paid technologists and assistants.

Newly graduated medical technologists at the baccalaureate level employed by the federal government in 1970 received $6,548. Those having experience, superior academic achievement, or a year of graduate study entered at $8,098. Depending on the amount and type of education and experience, medical laboratory assistants and technicians in the federal government earned starting salaries ranging from $4,621 to $5,853 a year in 1970.

Medical laboratory personnel generally work a 40-hour week. In hospitals, they can expect some night or weekend duty. Hospitals generally provide vacation and sick leave benefits; some have retirement plans.

Laboratories are generally well lighted and clean. Although unpleasant odors and specimens of many kinds of diseased tissue often are present, few hazards exist if proper methods of sterilization and handling of specimens, materials, and equipment are used.

## LICENSED PRACTICAL NURSE

### USUAL DUTIES

Licensed practical nurses assist in caring for persons physically or mentally ill or infirm. These include medical and surgical patients, convalescents, the handicapped, the aged, and others. Under the direction of physicians and registered nurses, they provide nursing care requiring technical knowledge but not the professional training of a registered nurse. In California and Texas, licensed practical nurses are known as licensed vocational nurses.

### CHARACTERISTICS OF THE JOB

About 370,000 licensed practical nurses were employed in 1970. The great majority were women.

About three-fifths of all licensed practical nurses were employed in hospitals. Most of the others worked in nursing homes, clinics, doctors' offices, sanitariums, and other long-term care facilities. Public health agencies and welfare and religious organizations also employed many licensed practical nurses. Some were self-employed working in hospitals or the homes of their patients.

### QUALIFICATIONS

All states and the District of Columbia regulate the preparation and licensing of practical nurses. Usually, licenses are issued only to those who have completed a course of instruction in practical nursing which has been approved by the state board of nursing, and who also have passed a licensing examination.

Young persons seeking to enroll in state-approved training programs usually must have completed at least two years of high school or its equivalent. Physical examinations are required and aptitude tests given. Some states accept candidates who have completed only the eighth or ninth grade. Other states require high school graduation. Many schools that do not require completion of high school nevertheless give preference to graduates.

Training includes both classroom study and clinical practice. Classroom instruction covers nursing concepts and principles and related subjects such as anatomy, physiology, medical-surgical nursing, administration of drugs, nutrition, first aid, and community health. This work is supplemented by laboratory practice and by supervised work in hospitals where students apply their skills to an actual nursing situation.

Applicants for the occupation of licensed practical nurse should have a deep concern for human welfare. Since working with sick and injured people can sometimes be upsetting, licensed practical nurses should be emotionally stable. They should be able to accept menial duties as part of their daily routine. Being part of a medical team, they must be able to follow orders and work under close supervision. Physical stamina also is an asset, since practical nurses must be on their feet a great deal. Good health is extremely important.

Opportunities for advancement are limited, unless workers take additional training. In-service educational programs enable some licensed practical nurses to prepare for work in specialized areas such as rehabilitation. Practical nurses cannot become registered nurses, however, unless they undertake additional schooling.

EMPLOYMENT PROSPECTS

Licensed practical nurses are expected to be in strong demand during the years ahead. Employment is expected to continue to rise very rapidly through the 1970's, and a large number of new jobs will have to be filled each year as health facilities continue to expand. In addition, many workers will be needed annually to replace licensed practical nurses who retire or stop working for other reasons. Opportunities for part-time work are expected to be plentiful.

OPPORTUNITIES FOR ADVANCEMENT

Licensed practical nurses employed in hospitals and medical schools received average starting salaries of about $110 a week in 1970, according to a national survey conducted by the University of Texas Medical Branch.

Many hospitals give licensed practical nurses periodic pay increases after specific periods of satisfactory service. Some hospitals also provide free laundering of uniforms. A few institutions provide free lodging. The scheduled work week is generally 40 hours but often it includes some work at night and on weekends and holidays. Paid holidays and vacations, and health insurance and pension plans are provided by many hospitals.

In private homes, licensed practical nurses usually are on duty for eight to twelve hours a day and go home at night. A few, on 24-hour duty, live at the homes where they are employed. The basic eight-hour fee in 1969 ranged from $15 to $30, according to the American Nurses' Association.

Salaries of licensed practical nurses employed by public health agencies averaged about $4,750 a year in 1970. The beginning annual salary in the federal government for persons having completed a state-approved program of study in practical nursing was $5,212 in 1970.

# MEDICAL ASSISTANT

## USUAL DUTIES

Medical assistants help physicians examine and treat patients, as well as keep abreast of the reams of paperwork that flow in the wake of current medical treatment.

Medical assistants carry out routine tasks such as preparing patients for examination, medical treatment, and surgery. They may help examine patients by checking weight, height, temperature, blood pressure, and making simple laboratory tests. Medical assistants help in treatment by instructing patients about medication and self-treatment at home, administering injections, applying surgical dressings, and taking electrocardiograms and X-rays, as well as sterilizing and cleaning instruments and other supplies. Medical assistants also perform a variety of clerical jobs. They keep patients' medical records, fill out medical and insurance forms, handle correspondence, schedule appointments, and act as receptionists. Other office duties include dictation, bookkeeping, billing, and receiving payments on bills. Medical assistants may also arrange instruments and equipment in the examining room, check office and laboratory supplies, and maintain the waiting, consulting and examination rooms in neat and orderly condition.

## CHARACTERISTICS OF THE JOB

An estimated 175,000 medical assistants were employed in 1970, almost all of whom were women. The large majority work in the offices of physicians in private practice. The remainder work in hospitals and medical clinics.

## QUALIFICATIONS

Most medical assistants employed in 1970 qualified for the occupation through training received in physicians' offices. A small number were trained in on-the-job programs sponsored by the Manpower Development and Training Act (MDTA). Further information about MDTA opportunities is available from State Employment Services. Some were trained in vocational programs offered by high schools, or by vocational institutes and junior colleges. Other learned their skills in adult education courses provided by post-secondary schools.

In general, applicants for on-the-job training or for post-secondary school academic training must be high school graduates of have equivalent education. High school courses in mathematics, sciences, and office practices are desirable for students seeking admission to medical assistant programs.

Junior college programs for medical assistants are being established in increasing numbers. Most are two-year programs, leading to an associate degree; the others are one-year programs and graduates receive a diploma. The programs require completion of designated academic courses as well as supervised on-the-job clinical experience. Among courses required are biology, chemistry, anatomy, and physiology; laboratory techniques and use of medical machines; medical assistant administrative and clinical procedures; medical terminology; medical office practices; reception of patients; and typing, shorthand, and accounting.

Medical assistants who meet the standards of the American Association of Medical Assistants (AAMA) may apply for the title of Certified Medical Assistant. An applicant for certification must pass a written examination and have a high school education. She must also be employed as a medical assistant and have at least three years' experience in the field. An applicant who has an associate degree in medical assisting need have only one year of experience. Certification is not a license and is not required for AMA membership; however, Certified Medical Assistants are usually considered by physicians to be high-calibre workers.

Persons who wish to become medical assistants should be able to get along with people, since they will be required to work closely with a variety of people. They should also be thorough, accurate, dependable, and conscientious.

EMPLOYMENT PROSPECTS

Opportunities for medical assistants are expected to be excellent through the 1970's, particularly for graduates of two-year junior college programs. Rapid growth in the occupation is anticipated during the decade. Many more medical assistants will be needed to help doctors engaged in patient care because of the shortage of physicians in most areas of the country and the increasing complexity of medical practice combined with a growing volume of paper work that must be completed in doctors' offices.

OPPORTUNITIES FOR ADVANCEMENT

In 1970, weekly salaries generally ranged from $90 to $125 for inexperienced medical assistants and from $125 to $160 for experienced assistants according to limited information available. The salaries of beginners depended on their training and other qualifications. Junior college graduates generally received higher starting salaries than those paid workers without any formal training.

Medical assistants usually have a 40-hour work week. Their hours, however, may be irregular. They may work evenings and Saturdays. If so, they receive equivalent time off during weekdays.

## LAND USE

PLANNING AIDE

PLANNING TECHNICIAN

URBAN PLANNER

ZONING TECHNICIAN

ZONING INSPECTOR

# PLANNING AIDE

## USUAL DUTIES

A planning aide position is the beginning level of paraprofessional work. The aide assists in land use planning research work at the local, regional, or state level. This includes assisting in the collection, organization, and analysis of data required in the development of new land use planning programs. The work of the aide involves providing technical assistance to higher level professional personnel in both office and field work.

## CHARACTERISTICS OF THE JOB

The job of the planning aide may consist of assignments working with superiors out in the field, or it may be confined to office duties. Supervision is conducted by a professional who reviews the aide's work for accuracy.

## QUALIFICATIONS

A high school diploma is recommended for this position. The planning aide should have a basic knowledge of rural or urban planning and must be able to work effectively with other people, including his superiors and the general public.

## EMPLOYMENT PROSPECTS

City, county, and regional planning is a growing field. Many aides will be needed to assist the planners with their work.

The planning aide may find federal employment with the U.S. Department of Housing and Urban Development. Also, job openings may exist with the state planning agency. Local municipalities are joining in regional planning agencies more often, so job prospects on the local level should be very good.

## OPPORTUNITIES FOR ADVANCEMENT

The planning aide may advance to a planning technician after one or more years of satisfactory performance on the job. Some form of technical education may help the individual prepare for the increased responsibility.

# PLANNING TECHNICIAN

## Planning Associate, Planning Analyst

### USUAL DUTIES

The planning technician is an individual who must be capable of collecting, organizing, and analyzing data required in the development of urban planning techniques. Personnel in this job are responsible for both office and field work necessary for carrying out the programs. Work may include the application of statistical analyses to projects. Work is performed independently and is subject to review by professional superiors. The technician may supervise and train planning aides.

### CHARACTERISTICS OF THE JOB

The planning technician performs moderately difficult jobs in the carrying out of planning programs. Assignments may be indoors in an office setting or out in the field, collecting data and working with other planners. The technician may interview local officials concerning community planning and development. This individual may advise agency officials on various aspects and requirements of the federal planning assistance program.

### QUALIFICATIONS

A minimum of a two-year technical degree in urban planning or equivalent work experience is required for the position of planning technician. A considerable knowledge of the principles, practices, and objectives of city, regional, and state planning is essential. Background in government administration, research techniques, and involvement in urban development is essential. The technician must be able to plan, organize, and carry out assignments and present results of his work effectively. This individual must be able to work well with associates and the general public.

### EMPLOYMENT PROSPECTS

City, county, and regional planning is a growing field. Many technicians will be needed to assist the planners with their work.

The planning technician may find federal employment with the U.S. Department of Housing and Urban Development. Also, job openings may exist with the state planning agency. Local municipalities are joining in regional planning agencies more often, so job prospects on the local level should be very good.

### OPPORTUNITIES FOR ADVANCEMENT

The planning technician may rise to the position of urban planner as positions become available. Several years of experience, additional formal education, and excellent performance in his present job are three essential factors for promotion.

# URBAN PLANNER

City Planner, Regional Planner, Land Planner, Town Planner

## USUAL DUTIES

The urban planner is concerned with the physical, social, and economic growth and development of cities and regions. However, the major emphasis is on the physical aspects. Comprehensive plans are developed to show the proposed uses of the land (residential, commercial, industrial, open space, recreation) as well as the distribution of public facilities such as roads, rapid transit, schools, and parks.

Some urban planners specialize in specific areas: transportation, urban renewal, urban design, economic and resource development planning, and social service (public services such as education, health services, criminal justice, environmental health, and social welfare).

## CHARACTERISTICS OF THE JOB

The urban planner is most likely to be employed in regions having high populations. Some of the planner's work is done in the office. The job may require field trips where the individual visits residential communities, industries, recreational facilities, etc., to gather information. Public presentations are a necessary and important part of the planner's job.

## QUALIFICATIONS

Minimum education requirements are a B.S. degree or professional experience. The planner should be able to speak well to community groups and cope with conflicts among various groups proposing differing opinions. An individual in this position should have considerable knowledge of planning principles and practices, as well as creativity in developing proposals to preserve society's scarce resources. A sound background in the social sciences is also necessary.

## EMPLOYMENT PROSPECTS

Planning is a relatively new profession and future employment opportunities look promising. Larger urban areas and regional planning agencies hold the greatest possibility for employment. There are positions for rural planners in less populated regions.

Experience has shown the need for minority groups to take part in the decision-making process. Local governments today have a keen interest in bringing promising young members of minority groups into the planning profession.

The urban planner may find federal employment with the U.S. Department of Housing and Urban Development. Also, job openings may exist with the state planning agency. Local municipalities are joining in regional planning agencies more often, so job prospects on the local level should be very good.

There were 7,000 urban planners in the United States in 1968. Estimates project 8,000 job openings per year throughout the 1970's.

OPPORTUNITIES FOR ADVANCEMENT

The urban planner can rise quickly to levels of higher responsibility. This individual's services are in demand all over the country and in other parts of the world. Advancement to a larger city or employment as a private consultant may be the next promotion for the urban planner. This individual could also advance to chief planner or a plan director, positions requiring more experience and responsibility.

# ZONING TECHNICIAN

## USUAL DUTIES

The zoning technician works under the supervision of a zoning inspector. Responsibilities include helping to prepare zoning maps, answering questions about zoning laws, writing reports, and keeping records. The zoning technician may work in the city, checking buildings to see that zoning regulations are followed. The technician helps the zoning inspector in handling zoning change requests and issuing permits.

## CHARACTERISTICS OF THE JOB

This job is primarily a 40-hour-a-week office job, with some work in the city doing building inspections.

## QUALIFICATIONS

A minimum of a two-year technical degree in zoning or urban planning or equivalent work experience is required for the position of zoning technician. Ability in speaking, working with people, and map-making is essential.

## EMPLOYMENT PROSPECTS

The field of zoning looks good for the future. An increasing number of zoning technicians will be needed to aid the zoning inspectors.

The zoning technician may find federal employment with the U.S. Department of Housing and Urban Development. Also, job openings may exist with the state planning agency. Local municipalities will need more zoning technicians as urban land development continues to expand, so job prospects on the local level should be very good.

## OPPORTUNITIES FOR ADVANCEMENT

The zoning technician may be promoted to zoning inspector following a year or more of satisfactory performance in the job. A baccalaureate degree may also be required.

# ZONING INSPECTOR

## USUAL DUTIES

Zoning inspectors must check to see that land and buildings are used only for the purposes allowed in the zoned district. Regulations such as lot size, location, and size of the buildings must be enforced. The zoning inspector works with building owners before they fix up old buildings to make sure all laws are followed. Permits are issued to that the owner can begin work. Occupancy permits are also given by the inspector. The zoning inspector checks new buildings to see that they will be used properly and that they meet all structural engineering standards, including safety regulations. Other duties include supervising technicians in map work or zoning inspections and handling zoning change requests. Zoning inspectors work closely with the local government body.

## CHARACTERISTICS OF THE JOB

Although much time is spent out in the city, the zoning inspector generally works a regular work week in an office. The job involves a lot of contact with people--consulting property owners in working out zoning problems, or working with lawyers and courts to negotiate legal problems.

## QUALIFICATIONS

Several years of successful on-the-job experience as a zoning technician plus a baccalaureate degree from an accredited college are necessary for this position.

## EMPLOYMENT PROSPECTS

Employment prospects in the zoning field are good. Individuals are needed to fill these positions as urban areas grow. More buildings are under construction and many old buildings are being renovated. Zoning inspectors are needed to issue permits and watch that no laws are being violated.

The zoning inspector may find federal employment with the U.S. Department of Housing and Urban Development. Also, job openings may exist with the state planning agency. Local municipalities will need more zoning inspectors as urban land development continues to expand, so job prospects on the local level should be very good.

## OPPORTUNITIES FOR ADVANCEMENT

The zoning inspector may advance to a position of greater responsibility, such as zoning administrator, after several years of satisfactory work performance.

# PARKS AND NATURAL AREAS

PARK FOREMAN

CAMPGROUND CARETAKER

PARK NATURALIST

# PARK FOREMAN

## USUAL DUTIES

The park foreman works in many locations, including municipal, state, and national parks, college campuses, public and private golf courses, cemeteries, school grounds, and land around municipal institutions. One major responsibility is the supervision of crews who are involved in the maintenance, operation, and development of grounds, buildings, equipment, trails, campsites, and roads.

Another area of responsibility is the acquisition of equipment and supplies. This would include assignment of these materials to the proper crews for day-to-day use.

The park foreman is often called upon to assist in the development of landscape and building plans and maintenance schedules. This individual routinely inspects grounds, facilities, and equipment and sometimes acts as park guard, patrolman, fire fighter, and interpreter.

## CHARACTERISTICS OF THE JOB

Park foremen work mostly outdoors as supervisors. Working hours and conditions depend on seasonal weather and the number of persons using park facilities.

A park foreman is not really the same as the foreman of a work crew. A work crew foreman in a park, sometimes called a crew chief, is usually in charge of one crew whereas the park foreman is in charge of many crews and individuals.

## QUALIFICATIONS

A high school education is needed and courses in horticulture, general science, mathematics, and agriculture are desirable. Applied vocational shop skills in carpentry, plumbing, and electricity are helpful.

Depending upon the type of park one might work in, a two-year technical course in horticulture, forestry, or turf grass management may be helpful. Any preparation for the position of a park foreman should include training in the effective supervision of people. This is what will distinguish the park foreman's role as different from that of the park workers under his direction.

Good physical condition, patience, tact, courtesy, and the ability to get along well with others are all prerequisites for the park foreman.

Those desiring state or federal employment must pass a competitive civil service examination.

EMPLOYMENT PROSPECTS

Prospects for employment in parks generally are good. Employment as a park foreman, however, will depend on the background experience and/or education of the person.

OPPORTUNITIES FOR ADVANCEMENT

An experienced park foreman may advance to positions such as park maintenance supervisor, park ranger, or park or golf course manager, depending on the type of park and the particular requirements for each position.

# CAMPGROUND CARETAKER

## USUAL DUTIES

The campground caretaker is involved in the maintenance, development, and protection of areas that are used for camping. These areas may be the grounds and physical facilities used for resident, day and overnight camps, as well as camping areas used by tent and trailer campers on an overnight basis.

Maintenance of campsites, roads, and other physical facilities usually includes repair, cleaning, painting, and simple plumbing and electrical work. Landscape maintenance, including mowing, pruning, fertilizing, and planting are also a part of the maintenance duties performed by the campground caretaker.

Most campground caretakers become involved in development projects such as constructing new buildings and landscaping new trails and campsites.

Another area of responsibility for the campground caretaker is the protection of the camp through the enforcement of campground rules and regulations. However, this area of responsibility may be supervised by rangers in the larger parks.

The campground caretaker also may be in charge of collecting fees, operating camp stores, renting equipment, and working in food service areas.

## CHARACTERISTICS OF THE JOB

Work as a campground caretaker may be steady or seasonal. There are some campgrounds that are open twelve months a year. There are some resident camps that may retain a caretaker for the full year, even though the camp is open only for two to two and one-half months. The work is generally outdoors.

## QUALIFICATIONS

Qualifications depend on the kind of camp in which the campground caretaker will work. A high school education with courses in agriculture and applied vocational shop skills would be beneficial for most campground caretaker positions.

Skills are needed in the care and operation of power and hand tools, tractors, lawnmowers, and other landscape equipment. The campground caretaker also should have skills in carpentry, electricity, and plumbing. Many caretakers in resident camps also are required to have skills in the maintenance of waterfront areas and facilities.

In positions where the campground caretaker is required to deal with the people using the campground, he should be tactful and courteous. In resident camp situations, he should enjoy being with small children.

EMPLOYMENT PROSPECTS

Future employment prospects for campground caretakers look good. Prospects for employment in overnight campgrounds depend upon the number of campers and amount of campground services needed. Campers and campgrounds have been on the increase in the past 15 years. Prospects look better in overnight campgrounds than in resident camps.

OPPORTUNITIES FOR ADVANCEMENT

Opportunities for advancement exist after a year or more of satisfactory work performance. The campground caretaker may advance to a position of greater responsibility, possibly as a park maintenance supervisor, park ranger, or park foreman.

# PARK NATURALIST

## USUAL DUTIES

The job of the park naturalist is to bring people and the natural world together. This usually is accomplished in four ways: guided tours, audio-visual presentations, natural history lectures and exhibits, and the publication of written material about the particular area.

In order to accomplish these tasks, the park or interpretive naturalist must keep an up-to-date inventory of the natural history of the park. The park naturalist keeps records of what plants are growing where, when they bloom, and their size, number, and condition. The same kinds of records are kept on animal populations in the park. A continuous record is kept on geological formations and weather conditions.

Interesting presentations depend upon the park naturalist's ability to share knowledge about natural resources and the history of an area. The park naturalist, therefore, must know what has gone on in the past, what is likely to happen in the future, and how man has affected the environment.

The park naturalist may be in charge of planning trails and campsites, collecting and maintaining natural history specimens, and planning exhibits. This person also may be responsible for conducting research, maintaining weather records, developing a library, promoting public relations, taking pictures, and enforcing laws.

## CHARACTERISTICS OF THE JOB

The park naturalist works an average of five days a week through the year, but there are peak and slack periods. The day may start at 12 noon and go until 9 p.m. if there is an evening program to present. Seasonal variations in park attendance also will affect this schedule. Park naturalists generally give presentations every weekend and many evenings during the summer months. Work is both outdoors and indoors.

## QUALIFICATIONS

Communication skills in speaking, writing, graphic arts, and knowledge about natural history are the kinds of qualifications that the park naturalist must have. Usually, this person has a four-year college degree in one of the natural sciences or interpretive services or has had a great amount of experience as a part-time naturalist. The job involves scientific research, keeping accurate records, and using and maintaining audio-visual and photographic equipment. Interest in and curiosity about nature, creativity, and ability to get along with people are qualities a park naturalist should possess.

Much of the interpretation done today is in an urban setting, either in parks, museums, or on the street. Persons interested in urban interpretation should have a special interest in urban problems and the relationship of urban development to natural history and people as well as the general qualifications mentioned above.

EMPLOYMENT PROSPECTS

Job opportunities in the interpretive services are found in federal, state, and local park departments, private museums, public and private schools, and wildlife agencies. The present emphasis at the federal level is for urban naturalists. There are still opportunities in other areas for those who may prefer a rural or suburban atmosphere.

OPPORTUNITIES FOR ADVANCEMENT

An experienced park naturalist may become a nature center director, park supervisor, director of environmental or outdoor education programs, or the chief of interpretive services in a park. Advancement depends upon experience, qualifications, and the structure and location of the agency or institution where the park naturalist is employed.

## WILDLIFE

GAME PROPAGATOR

GAME WARDEN

WILDLIFE TECHNICIAN

WILDLIFE BIOLOGIST

# GAME PROPAGATOR

## USUAL DUTIES

The game propagator may manage a state game farm or work for a private farm. One responsibility is to conduct programs of game propagation and distribution of quail, pheasant, and other game. The propagator supervises the work of gamekeepers and game farm workers and does technical work on the game farm. This work includes hatching, brooding, feeding, and caring for the game birds and animals. There is some field work in growing crops to feed the game.

The game propagator supervises work crews in the operation of incubators, hatcheries, brooders, and other farming and game propagating equipment. Schedules must be arranged so that operations are conducted at the proper times. Other duties are to direct the plowing and soil preparation procedures, planting, and finally harvesting of the grain which later is used as game feed.

The game propagator participates in the statewide distribution of game and waterfowl releases. This individual receives and raises new types of game birds, waterfowl, and animals which the state wishes to use for experimental purposes.

The game propagator patrols the game farm to enforce game laws. Other duties include keeping records and writing reports on game farm activities.

## CHARACTERISTICS OF THE JOB

Work is relatively steady throughout the year, but may vary according to the season. Work is mostly outdoors, but there is some indoor work such as record keeping and brooder operations.

## QUALIFICATIONS

The game propagator is expected to have two to three years of experience on game farms or college work in agriculture, game management or biological science.

The game propagator should be interested in farming, enjoy working with animals, and have a working knowledge of common game bird diseases and methods of treatment.

The game propagator needs skill and ability to operate and repair game farm equipment including regular farm tools and equipment, incubators, brooders, hatchers, and similar devices.

The game propagator must be in good physical condition and able to handle responsible duties.

EMPLOYMENT PROSPECTS

The future employment prospects for the game propagator look good. The increased popularity of recreational hunting will result in an increased demand for people in this field.

OPPORTUNITIES FOR ADVANCEMENT

The game propagator may advance to the position of game farm superintendent after several years of satisfactory work performance. Further education may be necessary to qualify for this position.

# GAME WARDEN

## Conservation Officer, Game Protector

### USUAL DUTIES

Game wardens patrol assigned areas of land and watch for violations of the fish and game laws. They check for illegal possession of fish and game, investigate complaints, question possible suspects, and issue warnings or make arrests. Claims for damages by wild animals to crops and livestock are investigated, and the game warden often assists in the settlement of these claims.

Another duty is to explain fish and game laws, rules, and regulations to sportsmen both in the field and in group meetings. The game warden may also be asked to speak on hunter safety in school programs.

The game warden also helps with conservation practices such as stocking fish in streams and releasing wild animals and birds.

### CHARACTERISTICS OF THE JOB

Work is steady throughout the year, but there is no set work week. Days and hours vary according to the patrol schedule. Work is mostly outdoors in all weather conditions.

### QUALIFICATIONS

To qualify, the candidate should be a high school graduate. Courses in biology and language arts are necessary.

An interest in hunting, fishing, and outdoor living are essential. The game warden must be strong and willing to work in many climatic conditions. The candidate must be friendly, patient, tactful, and courteous to the public. This individual must be able to enforce all rules and regulations strictly.

### EMPLOYMENT PROSPECTS

Prospects look fairly good for this position. All states require the services of game wardens. The increased popularity of recreational hunting will result in an increased demand for people in this field.

### OPPORTUNITIES FOR ADVANCEMENT

Advancement opportunities exist in the field and at division headquarters for positions of greater responsibility. The game warden may move into one of these positions after several years of satisfactory work performance.

# WILDLIFE TECHNICIAN

## USUAL DUTIES

The wildlife technician assists the wildlife biologist in wildlife management and studies of wildlife nutrition, behavior, and reproduction. The technician captures the wildlife species for study, marking, and transfer from one area to another. Opinion surveys may be conducted with visitors to park and wildlife preserves. Special equipment is used by the wildlife technician to follow movements of individual animals. Wildlife data are then summarized and written up in report form.

The wildlife technician may be in charge of maintaining experimental wildlife cages. Another responsibility is to assist in enforcing game laws during peak periods of sports activity.

## CHARACTERISTICS OF THE JOB

Work is steady throughout the year. The work week varies according to the seasonal work being done. Work usually is outdoors, in all climatic conditions.

## QUALIFICATIONS

A wildlife technician should have an associate degree in wildlife management, biological science, forestry, or a related field, or the equivalent in work experience.

This individual must enjoy working in the outdoors and should be able to handle equipment such as live game traps, tracking equipment, and firearms. A background in orienting (map and compass work) is helpful.

## EMPLOYMENT PROSPECTS

Opportunities for employment exist in federal and state government agencies, educational institutions, and in private organizations and industries.

Some of the federal agencies are: Bureau of Land Management, Bureau of Outdoor Recreation, Bureau of Indian Affairs, Bureau of Sport Fisheries and Wildlife, and the National Park Service of the U.S. Department of the Interior. Also, employment prospects exist in the U.S. Department of Agriculture with the Forest Service, Soil Conservation Service, and Extension Service.

State governments are the largest employers of wildlife technicians. These positions are located in state conservation agencies such as the Department of Natural Resources, Department of Fish and Game, Department of Environmental Resources, Department of Parks and Recreation, and the Department of Agriculture.

OPPORTUNITIES FOR ADVANCEMENT

The wildlife technician may advance to the position of wildlife biologist after several years of satisfactory work performance. Further education also may be necessary.

# WILDLIFE BIOLOGIST

## USUAL DUTIES

The wildlife biologist's work is centered on conducting wildlife research and management activities to maintain healthy wildlife. This involves field and laboratory work in game population surveys and autopsies of dead animals. Studies are done on food habits and the harvesting of game.

The wildlife biologist checks hunters in the field, operates game checking stations along highways, and provides technical assistance in setting hunting limits and in the management of game farms.

Another concern for the biologist is to help engineers and agronomists coordinate water resources and land use development so wildlife won't be affected. This individual is often asked to present wildlife conservation programs to camps and schools. Training sessions are offered to other branches of the Fish and Game Commission as well as to interested groups such as sportsman clubs.

## CHARACTERISTICS OF THE JOB

Work is steady throughout the year, usually with a non-standard work week. Work is performed both indoors and outdoors in all weather conditions.

## QUALIFICATIONS

The wildlife biologist should have a baccalaureate degree in wildlife management, zoology, ecology, or a closely related field. The candidate should enjoy the outdoors, have an interest in animals, and be physically able to work a non-standard work week under various weather conditions. The ability to communicate well with others is necessary, especially in the educational programs.

## EMPLOYMENT PROSPECTS

Somewhat limited employment opportunities for wildlife biologists exist in state and federal agencies, state universities, and community colleges. Some states require an advanced college degree to qualify for the position. A very limited number of positions exist in private companies.

## OPPORTUNITIES FOR ADVANCEMENT

The wildlife biologist may move up to a position of greater responsibility after a year or more of successful work performance. After meeting the required educational qualifications plus several years of practical experience, the wildlife biologist may merit the position of division or bureau chief.

# RECREATION

## HUNTING AND FISHING GUIDE

## RECREATION WORKER

# HUNTING AND FISHING GUIDE

## USUAL DUTIES

The hunting and fishing guide provides assistance to sports hunters and fishermen by finding game and fishing areas which offer recreational enjoyment. The guide organizes and leads hunting and fishing parties. This individual can also help by suggesting types of equipment to use or techniques useful in catching the prey.

The hunting and fishing guide may lead the hunting party along trails or by boats, horses, motor vehicles, or possibly airplanes. It is the job of the guide to make outdoor living as comfortable as possible, working closely with the party to pick suitable campsites and to keep the pace of travel suited to the ability of the customers.

## CHARACTERISTICS OF THE JOB

Work is seasonal, depending on the hunting and fishing seasons in the geographical area. Work is entirely outdoors and requires strenuous activity in all types of weather.

## QUALIFICATIONS

The job of the hunting and fishing guide is rigorous and varied. In order to live and work in all types of weather, the guide must master the skills and crafts necessary to survive in wilderness areas. This individual must know the geographic area, be acquainted with animal and fish species in the area, and be familiar with all hunting and fishing laws.

The hunting and fishing guide must know how to use, maintain, and repair the various hunting, fishing, and camping equipment the customers will be using. Ability to handle boats and canoes and knowledge of the care of livestock are helpful.

The hunting and fishing guide should be able to handle emergency situations and guide others to safety. This requires leadership ability, knowledge of first aid, ability to construct temporary shelters, and other survival techniques. Field care and cleaning of fish or game is as essential as the ability to cook.

## EMPLOYMENT PROSPECTS

There will be a limited number of job openings for hunting and fishing guides in the next ten years. These job openings will come about mostly because of the need to replace workers who will retire or leave their jobs for other reasons.

## OPPORTUNITIES FOR ADVANCEMENT

Some hunting and fishing guides advance to become managers of hunting and fishing camps and properties. Others become owners of these properties.

# RECREATION WORKER

## USUAL DUTIES

Modern technological advances increasingly have raised the standard of living and provided leisure time for most people. How people spend their nonworking hours is now a major concern. Recreation workers help people to enjoy and use their leisure time constructively by organizing individual and group activities and by administering physical, social, and cultural programs for all age groups at camps, playgrounds, community centers, and hospitals. They also operate recreational facilities and study the recreation needs of individuals and communities.

Recreation workers employed by local government and voluntary agencies direct activities at neighborhood playgrounds and indoor recreation centers. They provide instruction in the arts and crafts and in sports such as tennis and basketball. They may supervise recreational activities at correctional institutions and work closely with social workers in organizing programs of recreation for the young and the aged at community centers and social welfare agencies.

Many persons work in industrial, hospital, military, or school recreation. Recreational workers in industry plan programs for company employees and organize bowling leagues, softball teams, and similar activities. Sometimes, they plan fund drives and company social functions. Hospital recreation workers plan recreation programs for the ill and the handicapped in hospitals, convalescent homes, and other institutions. Working under medical direction, they organize and direct sports, dramatics, and arts and crafts for persons suffering from mental problems and physical disabilities. School recreation workers organize the leisure-time activities of school-age children during school days, weekends, and vacations.

Most part-time recreation workers and volunteers assist full-time workers during the summer months but a few assist throughout the year. Part-time workers are largely college students and teachers. They work primarily as recreation leaders and camp counselors, organizing and leading games and other activities at camps and playgrounds.

## CHARACTERISTICS OF THE JOB

About 13,500 professional recreation workers were employed full time in 1970; about one-half were women. The majority worked for local governments and voluntary agencies. Most of the remainder were employed by religious organizations or by the federal government in national parks, the Armed Forces, the Veterans Administration, and correctional institutions. Some recreational workers were employed by industry, and a few taught in colleges and universities.

Recreation workers are employed in all parts of the country; however, a large proportion are employed in California, Massachusetts, New Jersey, New York, Ohio, Pennsylvania and Texas.

QUALIFICATIONS

Most employers prefer college graduates who have majored in recreation, social science, or physical education for work in the recreation world. However, fewer than one-half of the recreation workers currently employed have this educational background. Persons interested in becoming recreation workers should take a broad range of courses in college. Specific courses in recreation include group leadership, program planning and organization, health and safety procedures, outdoor and indoor sports, dance, arts and crafts, and field work (actual recreation leadership experience).

Advanced courses in recreation or public administration leading to the master's degree are desirable for persons interested in higher level administrative positions. Students interested in industrial recreation may find it desirable to take courses in business administration, and those interested in working with the aged in hospitals as recreation specialists should take courses in psychology, health education, and sociology.

Training leading to a bachelor's degree with a major in recreation was available in over 130 schools in 1970. About 70 offered a master's degree and about 30 offered a doctorate in recreation. Over 60 junior colleges offer programs in recreation.

Young people planning a career as a recreation worker must have the ability to motivate people and be sensitive to their needs. Good health and physical stamina are required to participate in sports. Activity planning often calls for creativeness and resourcefulness. Since the recreation worker organizes sports, supervises art projects, and gives fund-raising speeches, he should have a variety of skills. Recreation workers should be able to accept responsibility and exercise judgment since they usually work alone.

To increase their leadership skills and understanding of people, students should obtain related work experience in high school and college. They may do volunteer, part-time, or summer work in recreation departments, camps, youth-serving organizations, institutions, and community centers.

Most college graduates entering the recreation field begin as leaders or specialists, although each year a small number of college graduates enter trainee programs that lead directly to recreation administration. A few large cities and organizations offer these programs which generally last one year.

Recreation leaders work directly with groups and individuals to organize and teach diversified activities, such as athletics and social recreation in indoor and outdoor centers. They also supervise nonprofessional workers and assist in administering recreation programs. Recreation specialists organize and develop one activity or several closely related activities. They sometimes oversee nonprofessional workers.

After a few years' experience, recreation leaders and specialists may become recreation directors; those having graduate training, however, may start at this level. Directors are responsible for the operation of the facilities, staff supervision, and the development and execution of programs at a particular recreation center, as well as the preparation of budgets and the analysis of recreation programs.

Advancement is sometimes possible through a combination of education and experience. Administrative jobs require varying years of experience in full-time recreation work, depending upon the size of the community or organization and the program.

EMPLOYMENT PROSPECTS

Employment of recreation workers is expected to increase very rapidly through the 1970's. Several thousand recreation workers will be needed annually for growth and to replace personnel who leave the field because of retirements, deaths, or transfers to other occupations. In recent years, the number of college graduates having a major in recreation has fallen far short of the demand, and this pattern is expected to continue. Thus, many new recreation workers will continue to be hired from the fields of social science, physical education, and health education. Persons having less than full professional training also will find employment opportunities. As a result of the great demand for recreation workers, part-time and volunteer personnel will be needed, particularly in social welfare agencies and at the local government level.

OPPORTUNITIES FOR ADVANCEMENT

Beginning recreation leaders having a bachelor's degree earned between $7,200 and $7,800 annually in 1970, according to the National Recreation and Park Association. In the same year, the salaries of recreation supervisors ranged from $8,500 to $10,000 depending upon their qualifications and the size of the community in which they were employed. Salaries of recreation directors or superintendents generally ranged from $12,000 in some small communities to over $22,000 in many large cities. Regions varied in their salary levels--higher salaries generally were paid in the West than in other areas of the country.

In 1970, the annual starting salary for inexperienced recreation workers in the federal government was $6,548 or $8,098, depending on their academic records or specialized training. Experienced recreation workers in federal positions generally earned between $9,900 and $14,200 annually.

The average work week for recreation workers is 40 hours, although some work upwards of 50 hours. A person entering the recreation field should expect some nightwork and irregular hours, for many recreation personnel work while other persons are enjoying their leisure time. Most public and private recreation agencies provide from two to four weeks' vacation and other fringe benefits, such as sick leave and hospital insurance.

# SOIL

SOIL CONSERVATION AIDE

SOIL CONSERVATION TECHNICIAN

SOIL CONSERVATIONIST

SOIL SCIENTIST

# SOIL CONSERVATION AIDE

## USUAL DUTIES

Under supervision, the soil conservation aide helps collect different kinds of information on natural resources for use in developing conservation practices and in conducting demonstrations and tours on soil and water conservation.

## CHARACTERISTICS OF THE JOB

Most of the work of the soil conservation aide is performed outdoors. The work week is usually 40 hours. Some positions are full time and others are seasonal.

## QUALIFICATIONS

The soil conservation aide should have a high school diploma, an interest in the use or care of natural resources, and agriculture-related experience. The candidate should be able to work well with others.

## EMPLOYMENT PROSPECTS

Job opportunities are fairly good. Local offices of the Soil Conservation Service of the U.S. Department of Agriculture, the Bureau of Indian Affairs of the U.S. Department of the Interior, and state and local government agencies employ soil conservation aides.

## OPPORTUNITIES FOR ADVANCEMENT

With additional on-the-job experience or post high school education that includes some course work in biology, physical science, forestry, engineering, or agriculture, the soil conservation aide may advance to soil conservation technician or other positions of greater responsibility.

# SOIL CONSERVATION TECHNICIAN

## USUAL DUTIES

The soil conservation technician advises and assists land owners and managers in carrying out soil and water conservation plans. This individual goes to farms, ranches, municipal watersheds, construction sites, and other locations to gather information on past and present land use, apparent water management problems, severity of erosion, etc. The soil conservation technician helps develop inventories and evaluations of natural resource data and assists the soil conservationist in preparing conservation plans. Among the conservation practices which the technician may help to install and maintain are ponds, cover crops, tree windbreaks, strip-cropping, terraces, contour planting, rotation grazing, wildlife habitat improvement, and many others.

## CHARACTERISTICS OF THE JOB

Much of the work of the soil conservation technician is done outdoors and involves working with the general public. This individual works in close cooperation with the soil conservationist. Work may be in any part of the United States, usually in rural areas.

## QUALIFICATIONS

The soil conservation technician must have a practical knowledge of methods and techniques of soil and water conservation. Entry level jobs require two years of agriculture-related experience or two years of appropriate post high school study which includes courses in biology, mathematics, physical sciences, engineering, or agriculture. The job requires the ability to communicate well with others.

## EMPLOYMENT PROSPECTS

With the current emphasis on environmental and resource conservation, job opportunities should be fairly good for soil conservation technicians. Employers include the Soil Conservation Service in the U.S. Department of Agriculture, the Bureau of Indian Affairs in the U.S. Department of the Interior, state and local governmental agencies such as conservation districts, and a few private land developers.

## OPPORTUNITIES FOR ADVANCEMENT

After successful on-the-job experience and training, the soil conservation technician may advance to positions of greater responsibility. Upon earning a B.S. degree in soil conservation or a closely related natural resource or agricultural field, the technician may advance to the position of soil conservationist.

# SOIL CONSERVATIONIST

## USUAL DUTIES

The soil conservationist works with land owners and managers to develop and carry out soil and water conservation plans for farms, ranches, housing developments, schools, airports, recreation areas, and land used for other purposes. This individual provides professional conservation leadership and helps officials of a conservation district and other local leaders make and carry out community and area natural resource conservation and development plans.

The soil conservationist supervises technical help on the use and installation of natural resource management systems that usually include a wide variety of conservation practices, such as those listed under soil conservation technician. Planning is done for watershed protection and flood prevention projects and coordinating multi-purpose rural development projects.

The soil conservationist works with people, including planning commissioners, citizens and civic groups, school boards, employees of many other government agencies, farmers and ranchers, land developers and contractors, and many others who use or manage land and water resources.

## CHARACTERISTICS OF THE JOB

The soil conservationist works both indoors and outdoors and usually has headquarters in a small town or city in any part of the United States. The work is steady and normally involves supervising a small staff of engineers and technicians. A large proportion of the work involves contacts with other people.

## QUALIFICATIONS

A candidate for the position of soil conservationist must have a B.S. or higher degree from an accredited college or university with a major in soil conservation or one of the closely related natural resources or agricultural fields, such as agronomy, forestry, wildlife biology, regional planning, agricultural education, or agricultural engineering. Because of the interdisciplinary nature of this occupation, experience that involves the use of techniques, principles, and methods from a variety of agricultural and natural resource disciplines is especially valuable. This individual should have the ability to get along well with others and possess well developed communication skills.

EMPLOYMENT PROSPECTS

The future looks promising for soil conservationists for more and more people are becoming concerned about the quality of the environment and recognize that proper use and care of soil and water resources are the foundation for environmental improvement and economic development. Most positions are with government agencies: Soil Conservation Service in the U.S. Department of Agriculture; Bureau of Indian Affairs and Bureau of Land Management in the U.S. Department of the Interior; Tennessee Valley Authority; and state and local government agencies which are involved in conservation, land planning and development, or pollution control programs.

OPPORTUNITIES FOR ADVANCEMENT

The soil conservationist may advance to higher levels or responsibility after demonstrating leadership and supervisory ability, developing specialized knowledge and skills through graduate level education and on-the-job experience, and above average performance in daily work. This individual may be placed in charge of the soil and water conservation programs for a large area and supervise a sizable professional staff or may be given technical leadership for a specific program.

# SOIL SCIENTIST

## USUAL DUTIES

The soil scientist tends to specialize in one of three areas: making soil surveys, doing special purpose soil investigations, or teaching and research.

By direct examination in the field, the soil scientist collects information about the soil and records it on maps and as field notes. Among the kinds of soil information noted are physical and chemical characteristics, slope, erosion, geological formations, vegetation, and other features. This individual helps present this information to landowners and operators and to technical specialists. More than 70,000 different kinds of soil have been identified in the United States. The soil scientist uses the scientific information gathered in the field to predict a soil's physical behavior and identify its capabilities and limitations for different uses.

The soil scientist may do special purpose investigations on specific soil problems to develop new management practices for particular soils. For instance, this individual might make a special study to forecast the behavior of soils under irrigation. The soil scientist works with technical specialists in other fields to integrate the findings in order to help develop recommendations for proper use and care of the soil.

The soil scientist who engages in research may perform a broad array of investigations into methods of improving use and management of soil and water resources. This individual might conduct experiments to improve knolwedge of soil-water-plant-animal relationships; investigate methods of classifying, mapping, and evaluating soils; or do experimental work to determine the effects on the soil of tillage, fertilization, crop rotations, drainage, and other management practices.

## CHARACTERISTICS OF THE JOB

Some of the work of the soil scientist is done outdoors and some in laboratories and offices. Work is steady. A beginning soil scientist works under the close guidance and supervision of experienced men.

## QUALIFICATIONS

The individual must have earned a B.S. or higher degree from an accredited college or university with a major in soil science or a related field of biological, physical, or earth sciences, including at least 15 credit hours in soils. The candidate should be capable of doing independent research.

EMPLOYMENT PROSPECTS

Opportunities for employment of the well trained soil scientist should be excellent. Among federal agencies that employ soil scientists are the U.S. Department of Agriculture, U.S. Department of the Interior, and the Tennessee Valley Authority. Jobs with federal agencies come under the U.S. Civil Service Commission classification system.

State universities and agricultural experiment stations employ soil scientists. A few are self-employed, some work for industrial or other private organizations, and a few work for cities.

OPPORTUNITIES FOR ADVANCEMENT

By demonstrating competence and capacity for doing independent work, the soil scientist can advance to increasing levels of responsibility. Advancement may require advanced training as well as keeping up-to-date in the field. The soil scientist might eventually be placed in charge of all soil science work in a state or at a university.

## SOLID WASTE

WASTE TREATMENT OPERATOR

WASTE DISPOSAL MEN

## WASTE-TREATMENT OPERATOR AND WASTE-DISPOSAL MEN

### USUAL DUTIES

Waste-treatment operators operate heat exchange units, pumps, compressors, and other equipment to decontaminate and dispose of radioactive waste liquids. Waste-disposal men seal contaminated wastes in concrete containers and transport the containers to a burial ground.

### QUALIFICATIONS

Specialized knowledge of nuclear energy, which is essential for most scientific and engineering positions in atomic energy, may be obtained at a university or sometimes on the job.

High school graduates can qualify as waste-treatment operators, but experience in reading electronic instruments or in a chemical laboratory is desirable. High school graduates also can qualify for employment as waste-disposal men. They receive on-the-job training in the operation of equipment and the avoidance of radiation hazards.

### EMPLOYMENT PROSPECTS

Total employment in the atomic energy field is expected to increase moderately during the 1970's as commercial activities in atomic energy expand and as new applications of this energy form are developed.

As more nuclear reactors are built and put into operation, employment will further increase both in the operation and maintenance of reactors and in related activities such as the fabrication and reprocessing of reactor fuel elements and the disposal of radioactive wastes.

### OPPORTUNITIES FOR ADVANCEMENT

In 1970, blue-collar workers employed by contractors at AEC laboratories and other installations had average straight-time hourly earnings of $4.11; blue-collar workers in all manufacturing industries had average earnings of $3.36 an hour.

# RANGE

RANGE AIDE

RANGE TECHNICIAN

RANGE SCIENTIST

# RANGE AIDE

## USUAL DUTIES

The range aide is the range scientist's helper. Under the scientist's guidance, this individual works in planting, spraying, road building, fire fighting, and counting numbers of animals in a given land area.

The range aide operates farm machinery on rangeland, sets markers to indicate grazing land boundaries, checks fences and reports on their condition.

## CHARACTERISTICS OF THE JOB

Work is seasonal. The range aide is most likely to be employed in the spring, summer, and fall months. Work is outdoors, and the job assignments vary with the location and season.

## QUALIFICATIONS

As a range aide, high school courses in biology, botany, agriculture, and shop practices may be helpful. Mechanical ability is an asset. The range aide needs to be in good physical condition.

## EMPLOYMENT PROSPECTS

Future employment prospects for rangeland workers are expected to be very good. The need to maintain rangelands to provide water, forage, wildlife, and recreation makes job prospects promising.

The range aide may be employed by the large public agencies of the federal government. For example, the aide may be employed by the Forest Service of the U.S. Department of Agriculture, or by the Bureau of Land Management, Bureau of Indian Affairs, and Fish and Wildlife Service of the U.S. Department of the Interior. Some range aides may be employed by the U.S. Department of Defense, U.S. Department of Commerce, and the Tennessee Valley Authority.

Job openings also may be found at the state level with agencies such as the Department of Agriculture, Department of Environmental Resources, or Department of Fish and Game.

Employment opportunities also exist with many county or city governments which own rangelands managed for park or watershed protection purposes.

# RANGE TECHNICIAN

## USUAL DUTIES

The range technician supervises skilled workers in controlling undesirable plants and animals. This involves seeding, fertilizing, and other management operations. Improvement of wildlife surroundings and maintaining watersheds are part of the range technician's job. Surveys of the rangeland are conducted to determine numbers of plants and livestock and to see how many people are using the land for recreation.

## CHARACTERISTICS OF THE JOB

The range technician works throughout the year, but is busiest during the spring, summer, and fall months. At these times work is outdoors. Work may involve using map and survey equipment, often in an airplane. During the winter most of the time is spent indoors, planning future activities and presenting educational programs.

## QUALIFICATIONS

The range technician should have an associate degree in range management, agronomy, forestry, or a related field, or equivalent work experience. The technician must enjoy working outdoors.

## EMPLOYMENT PROSPECTS

Future employment prospects for rangeland workers are expected to be very good. The need to maintain rangelands to provide water, forage, wildlife, and recreation makes job prospects promising.

The range technician may be employed by the large public agencies of the federal government. He may be employed by the Forest Service of the U.S. Department of Agriculture, or by the Bureau of Land Management, Bureau of Indian Affairs, and Fish and Wildlife Service of the U.S. Department of the Interior. Some range technicians may be employed by the U.S. Department of Defense, U.S. Department of Commerce, and the Tennessee Valley Authority.

Job openings also may be found at the state level with such agencies as the Department of Agriculture, Department of Environmental Resources, or Department of Fish and Game.

Employment opportunities also exist with many county or city governments which own rangelands managed for park or watershed protection purposes.

## OPPORTUNITIES FOR ADVANCEMENT

The range technician may advance to the position of range manager after a year or more of satisfactory work performance. This may require a baccalaureate degree in range management or a related field.

# RANGE SCIENTIST

## USUAL DUTIES

The range scientist has the responsibility of managing, developing, and protecting rangelands. Use of rangeland must be planned to gain the most benefit for all. To do this the manager must consider all uses--livestock and wildlife, timber and grasses, watershed protection, and use by people for recreation.

The range scientist decides how many animals can graze on the rangeland and what types of animals are most suitable. For example, the scientist may decide that 200 sheep can graze on one area of land and 100 cows can graze on another area. Seasons of the year that rangelands can be used for grazing are determined by the range scientist.

The range scientist develops and restores rangeland which had been overgrazed or burned. This may involve reestablishing grazing areas with grass or planting trees.

The range scientist is constantly on the alert for fires and must know techniques of fire prevention and fire fighting. Pests and diseases on the range are also a major concern, and the scientist must know how to control them.

In order to conserve rangelands, the range scientist plans for planting grasses and trees to protect against soil erosion and water loss.

Other duties include helping private land owners with range management practices and offering educational programs to school and local organizations. The range scientist also conducts research on the rangeland and writes reports.

## CHARACTERISTICS OF THE JOB

Work is steady throughout the year. The work week varies according to the season and the type of work being done. In the spring, summer, and fall, work is mostly outdoors. In the winter, much time is spent planning future activities and presenting educational programs to interested groups.

## EMPLOYMENT PROSPECTS

Future employment prospects for rangeland workers are expected to be very good. The need to maintain rangelands to provide water, forage, wildlife, and recreation makes job prospects promising.

The range scientist may be employed by the large agencies of the federal government. There are positions in the Forest Service of the U.S. Department of Agriculture, and in the Bureau of Land Management, Bureau of Indian Affairs, and the Fish and Wildlife Service of the U.S. Department of the Interior. Some range scientists may be employed by the U.S. Department of Defense, U.S. Department of Commerce, and the Tennessee Valley Authority.

Job openings also may be found at the state level with such agencies as the Department of Agriculture, Department of Environmental Resources, or Department of Fish and Game.

Employment opportunities also exist with any county or city governments which own rangelands managed for park or watershed protection purposes.

OPPORTUNITIES FOR ADVANCEMENT

After several years of work experience, the range scientist may move into a position of greater responsibility such as having a greater area of land to manage. Further education may be necessary to qualify for a new position.

## WATER

WATER RESOURCE INVESTIGATOR

HYDROLOGIST

WATER WELL INSPECTOR

WATER TREATMENT PLANT TECHNICIAN

WASTEWATER TREATMENT PLANT TECHNICIAN

OCEANOGRAPHER

# WATER RESOURCE INVESTIGATOR

## USUAL DUTIES

It is the job of the water resources investigator to study the sources of water pollution in an assigned area. Dumps, rural sewage systems, sawmills, industrial plants, restaurants, and motels are checked for stream pollution.

The investigator uses dye tests and collects samples to determine pollution and pollution sources. Those persons responsible for the pollution are then contacted. The water resources investigator explains the water laws and suggests corrective measures to stop violations.

Reports of the investigator's studies are prepared and constitute official records. This individual attends hearings as directed and appears in court when necessary. Another duty involves monitoring industries for the quality and quantity of discharges.

## CHARACTERISTICS OF THE JOB

Work is steady throughout the year, usually with a 5-day, 40-hour work week. Most work is outdoors but some office work and report writing is required.

## QUALIFICATIONS

The water resource investigator should have a high school diploma. Courses in chemistry, mathematics, science, and English are helpful. A college degree in an appropriate field also is helpful and may lead to advancement and promotion.

Since the water resource investigator needs to find the causes and effects of water pollution, this individual should be able to conduct investigations, gather data, and prepare comprehensive reports. Knowledge of laws and policies applicable to water supplies and pollution control is helpful. It is also necessary for the investigator to establish tactful relations with property owners and those causing pollution.

## EMPLOYMENT PROSPECTS

The future job situation for the water resource investigator is excellent. There should be many opportunities for people interested in this area.

## OPPORTUNITIES FOR ADVANCEMENT

Advancement opportunities are good. The water resource investigator may move up to a position of greater responsibility after a year or more of satsifactory work. An associate or baccalaureate degree may be required to meet the qualifications of advancement.

# HYDROLOGIST

## USUAL DUTIES

The hydrologist works in the area of water resources, conducting scientific surveys and field investigations on water supplies and water use in connection with current and future needs. In some states where water is in short supply, the hydrologist assists in the issuing of permits and licenses for water use.

In some situations, applicants for water use permits may have conflicting interests. When this happens, the hydrologist conducts hearings to inform the permit applicants of the state laws relating to water use and priorities. An attmept is made to work out a satisfactory settlement between conflicting interests. This may mean additional investigations, and if a settlement cannot be made, reports are prepared and further action recommended.

Hydrologists are also involved in water storage. They obtain or verify general reservoir information and make safety inspections during and/or after construction. A check is made on water flow into and out of the reservoir to make sure it follows water use permit requirements.

The hydrologist acts as an information person between a state's water resource board and other state or federal agencies and private individuals concerned with water resources.

## CHARACTERISTICS OF THE JOB

Work is steady throughout the year with a 40-hour, 5-day work week. Work is performed indoors as well as outdoors. Work is at a professional level.

## QUALIFICATIONS

The hydrologist needs a baccalaureate degree in civil, hydraulic, or hydrological engineering or other closely related field. Work in water quality control and water pollution control would be helpful.

Skill and ability is needed in hydrological survey methods and equipment. Also necessary is knowledge of the principles of surface water hydrology and laws and regulations concerning water use and water rights.

## EMPLOYMENT PROSPECTS

The future job situation for a hydrologist is excellent.

OPPORTUNITIES FOR ADVANCEMENT

Advancement opportunities for better positions are good. The hydrologist may move up to a position of greater responsibility after a year or more of satisfactory work. An advanced degree may be required to meet qualifications of the new job.

## WATER WELL INSPECTOR

Environmental Health Technician

### USUAL DUTIES

The water well inspector checks well water to make sure it is safe for human consumption. Samples are taken from the well and tested for harmful or unwanted chemicals or minerals. Tests are also run for microorganisms which are harmful to human or animal health.

If the tests indicate the well water is safe, the inspector issues a permit for its use. If the tests indicate harmful or unwanted chemicals or minerals in the water, the inspector suggests methods to remove them. If the tests indicate disease-causing organisms, the inspector must determine the source of the pollution. The source may be a wastewater system close to the well site. The inspector may have to make dye tests to determine the actual cause of pollution. If the cause of pollution cannot be found or corrected, the inspector may suggest methods to make well water potable.

### CHARACTERISTICS OF THE JOB

Work is steady throughout the year with the usual 40-hour, 5-day week. Work is indoors in the laboratory and outdoors at the well site.

### QUALIFICATIONS

The minimum requirement for a water well inspector is a high school diploma. Courses in chemistry, mathematics, English, science, agriculture, or shop practices are helpful. Water well inspectors need to know how to use and maintain mechanical and electronic equipment.

The water well inspector should be able to express ideas clearly in oral and written reports and know how to recognize possible problem areas in well water testing.

The inspector also needs to know how to establish and maintain effective working relations with the employing agency and the public.

### EMPLOYMENT PROSPECTS

Employment prospects should improve in the future. The water well inspector may be employed by state or local sanitation departments, boards of health, and commercial companies. He also may be employed at the federal level by the Public Health Service.

OPPORTUNITIES FOR ADVANCEMENT

The water well inspector may advance to positions of greater responsibility after several years of satisfactory work performance. These positions may be with federal, state, or local agencies as a public health supervisor or environmental health supervisor. Further education may be necessary for these new positions.

# WATER TREATMENT PLANT TECHNICIAN

## USUAL DUTIES

The water treatment plant technician operates a water, waste water, or mine drainage treatment plant. The job involves supervising the maintenance and repair of water treatment equipment and the collecting and testing of water samples to check for water quality. The technician checks to see that the water is safe to drink, including the oxygen level of the water, mineral content, and amount of pollutants. This individual directs the application of chemical treatments when needed. Other duties include reading meters, keeping records, and keeping the plant operating properly.

## CHARACTERISTICS OF THE JOB

This is a paraprofessional position requiring the individual to direct and supervise skilled workers. The water treatment plant technician works around equipment both indoors and outdoors, depending on the plant set-up. Some of the work involves reading instruments and keeping records.

## QUALIFICATIONS

The water treatment plant technician should have training in water treatment technology, or equivalent work experience. An understanding of the water system and its importance to the community is necessary, along with knowledge of the equipment used to test water. The technician must be able to use tools and follow safety rules. This individual must be able to give directions to other workers.

## EMPLOYMENT PROSPECTS

The future looks very promising for water treatment plant technicians. Opportunities exist for employment in federal, state, and local government agencies. Government agencies which may hire a water treatment plant technician include: U.S. Department of the Interior, U.S. Department of Housing and Urban Development, U.S. Department of Health, Education, and Welfare, and the U.S. Department of Defense.

State agencies also may employ water treatment plant technicians. Some agencies are: Department of Agriculture, Department of Environmental Resources, and the Department of Urban Development. State positions usually are classified civil service posts and require a rating on a competitive entrance examination.

Employment opportunities also exist with many county or municipal governments which are involved with water treatment.

Many employment opportunities for technicians may be found with private industries which manufacture water pollution control and monitoring equipment and with consulting engineering firms.

OPPORTUNITIES FOR ADVANCEMENT

The water treatment plant technician may advance to the position of water treatment plant operator or filter plant supervisor after a minimum of one year of experience. A two-year associate degree in the field of water treatment technology or the equivalent in time or education will enhance one's opportunities for advancement.

# WASTEWATER TREATMENT PLANT TECHNICIAN

## USUAL DUTIES

The job of the wastewater treatment plant technician is to help operate a wastewater treatment plant. This means working with water purification chemists, sanitarians, purification plant operators and sewage-disposal engineers to add chemicals that will purify wastewater. The job also includes reading and understanding meters and gauges, keeping daily records, and related duties. The technician supervises skilled workers in controlling the flow and processing of wastewater.

## CHARACTERISTICS OF THE JOB

Wastewater treatment plant technicians do physical work both indoors and outdoors. They may also work at a desk recording meter readings and keeping daily records. Wastewater treatment plant technicians do a lot of work with machinery.

## QUALIFICATIONS

The wastewater treatment plant technician should have a two-year associate degree or certificate in water and wastewater treatment technology or equivalent work experience. This individual should have an understanding of water pollution control, and be able to follow instructions and perform duties carefully. The technician has to work with tools and equipment and must be able to read and understand meters and gauges. The ability to supervise others is helpful.

## EMPLOYMENT PROSPECTS

Many wastewater treatment plant technician jobs should be available in the future. This area is expanding because of federal orders to upgrade the treatment of wastewater. There are a lot of positions opening in federal, state, and local government agencies. There also are job openings with wastewater equipment manufacturing companies.

Federal government agencies which may employ wastewater treatment plant technicians include: U.S. Department of Agriculture, U.S. Department of the Interior, U.S. Department of Housing and Urban Affairs, U.S. Department of Health, Education, and Welfare, and the U.S. Department of Defense.

State agencies also may employ wastewater treatment plant technicians. Some agencies are: Department of Agriculture, Department of Environmental Resources, and the Department of Urban Development. State positions usually are classified civil service posts and require a rating on a competitive entrance examination.

Employment opportunities for technicians may be found with private industries which manufacture water pollution control and monitoring equipment and with consulting engineering firms.

OPPORTUNITIES FOR ADVANCEMENT

The wastewater treatment plant technician may advance to the position of wastewater treatment plant operator after at least one year's work experience. A two-year associate degree in the field of water and wastewater technology may be necessary. Other positions to which the technician may advance are water purification chemist, sanitarian, or sewage-disposal engineer. In many of these cases, a baccalaureate degree is required for advancement.

# OCEANOGRAPHER

## USUAL DUTIES

The oceanographer studies the ocean and its contents, movements and shorelines. Since this is such a large field, there are many areas in which an oceanographer may specialize.

Some oceanographers specialize in studying plant and animal life in the seas. The oceanographer observes how these living things grow, live, and die and how they relate to the total ecology of the ocean. Some oceanographers study the structure of the ocean floor, tides, water movement, and other physical characteristics. The oceanographer observes waves and their effects on the ocean floor and shorelines. Water currents and the movement of sediment in the ocean are studied.

## CHARACTERISTICS OF THE JOB

Work is steady throughout the year. The oceanographer works primarily outdoors. Work may be on a ship, and duties may include diving and swimming.

Since the ocean is so large, working conditions may vary from arctic cold to tropical heat and from the calm water of bays to the rough open waters of oceans.

## QUALIFICATIONS

A baccalaureate degree in Oceanography or Marine Biology is essential. Physical stamina is important since a lot of the work is rigorous. You may be out on sea voyages or you may be diving into unknown waters. Skin diving is an important part of Oceanography.

The oceanographer must be able to work well with others, think creatively, and carry out projects. In addition, the oceanographer must record and analyze data, write reports and papers, and present project results to other people.

## EMPLOYMENT PROSPECTS

The future job outlook for oceanographers is excellent. They generally are hired by marine industries, marine laboratories, or various state or federal government agencies. Many oceanographers are hired by the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce.

There is a rapidly growing demand for oceanographers in many industries associated with marine science and engineering. Industries such as petroleum, natural gas, and precious stone mining conduct marine operations. Ocenaographer consulting firms and fishing industries employ oceanographers.

## OPPORTUNITIES FOR ADVANCEMENT

Opportunities for advancement to better positions are excellent. The oceanographer may move up to a position of greater responsibility after a year or more of satisfactory work. Further education may be necessary for advancement.

## MINERALS AND MINERAL FUELS

OPEN-PIT MINE CONSERVATION TECHNICIAN

MINING AREA RESTORATION TECHNICIAN

OIL AND GAS INSPECTOR

PETROLEUM GEOLOGIST

# OPEN-PIT MINE CONSERVATION TECHNICIAN

## USUAL DUTIES

The open-pit mine conservation technician assists the open-pit mine conservation inspector to see that state open-pit mining laws are followed. The job includes checking all mine accidents to find out what caused them. The open-pit mine conservation technician keeps records on the condition of the mines, inspects machinery that miners use, and makes stream surveys to see that acid mine drainage water does not pollute rivers and lakes.

## CHARACTERISTICS OF THE JOB

The open-pit mine conservation technician must be in excellent physical condition since a lot of the work is done in mines. This work involves working with machinery, walking through mines, and talking with miners.

## QUALIFICATIONS

The open-pit mine conservation technician should have a two-year associate degree in mine technology or equivalent work experience. This individual should know open-pit mining laws, how mining machinery works, and safety and first aid methods. The mine conservation technician should be able to use conservation practices in his work and interpret maps of open-pit mines. In addition, this individual must be able to write and to work well with others.

## EMPLOYMENT PROSPECTS

Future opportunities for the open-pit mine conservation technician look good. Technicians are needed to see that mining operations are done safely and without destroying our natural resources.

## OPPORTUNITIES FOR ADVANCEMENT

The open-pit mine conservation technician may advance to open-pit mine conservation inspector which is a position of greater responsibility. Minimum requirements are a two-year degree in mine technology plus one year of experience.

# MINING AREA RESTORATION TECHNICIAN

## USUAL DUTIES

The mine area restoration technician works under the supervision of the mining area restoration supervisor. This job involves a program to discover and stop dangerous, unhealthy, and ugly environmental conditions caused by poor mining practices. This individual checks land, water, and air to see if the mine is causing pollution and works to help the miners stop the pollution. The mining area restoration technician works in programs to close old mines for safety to the public, stop mine fires, and clean up acid mine water.

## CHARACTERISTICS OF THE JOB

The mining area restoration technician must be in excellent physical condition. In addition to inspecting mines, this individual also does desk work which includes recording information for supervisors.

## QUALIFICATIONS

The mining area restoration technician should have a two-year associate degree in mine technology or equivalent work experience. In addition to understanding mining and mine safety and conservation laws, the candidate should have a background in methods of dust control, mine ventilation, acid mine water treatment, air and water pollution, and the control of mine fires. A mining area restoration technician should know how to run mine equipment and must be able to work well with others.

## EMPLOYMENT PROSPECTS

Jobs should be available for mining area restoration technicians in the future. Many agencies are concerned with restoring mined land to a safer, more beautiful condition.

## OPPORTUNITIES FOR ADVANCEMENT

The mining area restoration technician may advance to the position of mining area restoration supervisor. This requires a minimum two-year associate degree in mine technology and at least one year of on-the-job experience.

# OIL AND GAS INSPECTOR

## USUAL DUTIES

The oil and gas inspector works for environmental safety by enforcing laws dealing with oil and gas resources. In addition to checking oil and gas fields to insure that all drilling and production facilities are complying with state laws and regulations, this individual also checks gas producing and gas sales facilities to prevent waste of this natural resource.

In some states, the inspector checks pipeline connections and gas measuring devices. The oil and gas inspector also performs production capability tests on oil and gas wells to determine accuracy of production reports submitted by the oil and gas companies.

The inspector checks and inspects oil and gas producing facilities to insure that waste by-products from the oil and gas are not polluting the environment, and assists superiors in conducting any special field investigations deemed necessary.

The inspector's reports of all field inspections and investigations constitute official records that can be used in court hearings. At times, this individual may be called to appear in court to present evidence against an oil or gas company accused of violating oil and gas producing laws and regulations.

The inspector is constantly checking production facilities to find fire hazards. The oil and gas inspector checks facilities to make certain that drilling permits have been secured and safety equipment is being used. This individual also inspects for proper installation of mud pits and inspects waste oil disposal. The inspector is in charge of all wells.

## CHARACTERISTICS OF THE JOB

Work is steady throughout the year, usually with a five-day, forty-hour week. Work is performed indoors and outdoors.

## QUALIFICATIONS

The oil and gas inspector should have a minimum of a high school diploma with courses in chemistry, mathematics, English, agriculture, and shop practices. Previous experience as a production worker in the oil and gas field is required.

College training in geology or engineering is helpful and will increase advancement opportunities.

EMPLOYMENT PROSPECTS

Future employment prospects for oil and gas inspectors are needed in the field and only moderate increases in employment are expected.

OPPORTUNITIES FOR ADVANCEMENT

The oil and gas inspector may advance to a position of greater responsibility after several years of satisfactory work experience. This may require further education. Advancement to a new position may mean that the individual will supervise other inspectors.

# PETROLEUM GEOLOGIST

## USUAL DUTIES

The petroleum geologist has the important responsibility of finding economic deposits of oil and gas. This work includes a field study of rock outcrops, studying fossils, and making maps which show the structure or alignment of the surface rock formations. After collecting and studying data, the petroleum geologist makes subsurface maps which show the alignment, thickness, and likely areas for oil or gas deposits in subsurface rock formations.

After all data are analyzed and presented to the management, the petroleum geologist recommends areas for land purchase or rental upon which exploratory wells will be drilled for oil or gas.

During the drilling operation the geologist "sits on the well"; that is, the individual lives at the well site or may visit it periodically to study the rock cores and to run the necessary tests to evaluate the various rock formations encountered.

## CHARACTERISTICS OF THE JOB

The petroleum geologist, when in charge of a drilling operation, is responsible 24 hours a day for its progress. He may supervise several wells at one time. The work can be permanent as an employee of an oil company or it can be temporary work as a consultant.

A petroleum geologist's work is performed both indoors and outdoors.

## QUALIFICATIONS

A college degree in geology is necessary to perform the work of a petroleum geologist. Along with the degree, the candidate needs skills in mapping and drafting. The petroleum geologist also needs the ability to prepare clear and concise technical reports.

The petroleum geologist must also have the ability to meet and deal with people as well as to establish and maintain effective working relationships with fellow workers, property owners, and the general public.

## EMPLOYMENT PROSPECTS

In the past, employment has fluctuated with the demand for energy sources. Today, our energy supply will decrease unless new sources are found by the petroleum geologist. Work opportunities are very good and should remain good in the foreseeable future. Many are employed by the U.S. Geological Survey.

OPPORTUNITIES FOR ADVANCEMENT

Prospects for advancement within the petroleum field are excellent for any well qualified geologist. Being a professional person, a petroleum geologist may go into business for himself and become a consultant.

# NOISE

BIOMEDICAL ENGINEER

INDUSTRIAL ENGINEER

MECHANICAL ENGINEER

SPEECH PATHOLOGISTS AND AUDIOLOGIST

PHYSICIST

# BIOMEDICAL ENGINEER

## USUAL DUTIES

Biomedical engineers use engineering principles to solve medical and health related problems. Most biomedical engineers do research, working with life scientists, chemists, and the medical profession to study the engineering aspects of the biological systems of man and animals. Some design and develop medical instruments and devices that now include artificial hearts and kidneys to assist medical personnel in observing, mitigating, or alleviating physical ailments or deformities. Biomedical engineers have developed lasers for surgery and cardiac pacemakers for regulating the heartbeat. Other biomedical engineers adapt the computer to medical science. Biomedical engineers also design and construct systems which mechanize and automate laboratory and clinical procedures. A few biomedical engineers sell medical instruments and equipment to doctors, research centers, and hospitals.

## CHARACTERISTICS OF THE JOB

In 1970 most of the estimated 3,000 biomedical engineers were teaching and doing research in colleges and universities. Some were employed by the federal government, primarily in the National Aeronautics and Space Administration. Some work in state institutions, and a growing number are employed in private industry to develop new apparatus, processes, and techniques, or in sales related positions.

## QUALIFICATIONS

The minimum educational requirement for a beginning position as a biomedical engineer is the bachelor's degree. Graduate training is required for most entrance positions in research and teaching. Graduate work also is needed for advancement to most high-level positions in all types of work.

## EMPLOYMENT PROSPECTS

Employment opportunities for biomedical engineers are expected to be very favorable through the 1970's. Although biomedical engineering currently is a small field and has few openings compared with the larger branches of engineering, the number of graduates also is small. Thus, opportunities should be very favorable for both new graduates and qualified scientists and engineers.

## OPPORTUNITIES FOR ADVANCEMENT

M.S. and Ph.D. graduates will be in strong demand to teach and fill positions resulting from increased expenditures for research in areas such as prosthetics and cybernetics. Research could create new positions in instrumentation and systems for the delivery of health services.

# INDUSTRIAL ENGINEER

## USUAL DUTIES

Industrial engineers determine the most effective methods of using the basic factors of production manpower, machines, and materials. They are concerned with people and "things," in contrast to engineers in other specialities who generally are concerned more with developmental work in subject fields, such as power and mechanics.

They may design systems for data processing and apply operations research techniques to complex organizational, production, and related problems. Industrial engineers also develop management control systems to aid in financial planning and cost analysis, design production planning and control systems to insure coordination of activities and to control the quality of products, and may design and improve systems for the physical distribution of goods and services. Other activities of industrial engineers include plant location surveys, where consideration is given to sources of raw materials, availability of a work force, financing, and taxes, and the development of wage and salary administration and job evaluation programs.

## CHARACTERISTICS OF THE JOB

More than two-thirds of the estimated 125,000 industrial engineers employed in early 1970 were in manufacturing industries. They were more widely distributed among manufacturing industries than were those in other branches of engineering. Some worked for insurance companies, construction and mining firms, and public utilities. Others were employed by retail organizations and other large business enterprises to improve operating efficiency. Still others worked for government agencies and educational institutions. A few were independent consulting engineers.

## QUALIFICATIONS

The minimum educational requirement for an industrial engineer is a bachelor's degree. Many positions require a master's degree or a Ph.D.

## EMPLOYMENT PROSPECTS

The outlook is for very rapid growth of employment in this branch of the profession through the 1970's. The increasing complexity of industrial operations and the expansion of automated processes, coupled with the growth of the nation's industries, are among the major factors expected to increase the demand for industrial engineers. Growing recognition of the importance of scientific management and safety engineering in reducing costs and increasing productivity also is expected to stimulate the demand for persons in this branch of engineering.

OPPORTUNITIES FOR ADVANCEMENT

There are numerous opportunities for advancement in industrial engineering. Many positions at higher levels require advanced degrees.

# MECHANICAL ENGINEER

## USUAL DUTIES

Mechanical engineers are concerned with the production, transmission, and use of power. They design and develop machines which produce power, such as internal combustion engines, steam and gas turbines, jet and rocket engines, and nuclear reactors. They also design and develop a great variety of machines which use power--refrigeration and air conditioning equipment, elevators, machine tools, printing presses, steel rolling mills, and many others.

Many specialized areas of work have developed within mechanical engineering, and because they are employed in nearly all industries, their specific work varies with the industry and the function performed. Among these specialities are those concerned with motor vehicles, marine equipment, railroad equipment, rocket engines, steam power, heating, ventilating and air conditioning, hydraulics or fluid mechanics, instrumentation, ordnance, and machines for specialized industries, such as petroleum, rubber and plastics, and construction.

## CHARACTERISTICS OF THE JOB

About 220,000 mechanical engineers were employed in the United States in 1970. Nearly all manufacturing and nonmanufacturing industries employed some members of the profession. However, nearly three-fourths of all mechanical engineers were employed in manufacturing industries--mainly in the primary and fabricated metals, machinery, transportation equipment, and electrical equipment industries. Others were employed in government agencies, educational institutions, and consulting engineering firms. Some worked as independent consulting engineers.

## QUALIFICATIONS

The minimum educational requirement for a mechanical engineer is a bachelor's degree.

## EMPLOYMENT PROSPECTS

The outlook in mechanical engineering--the second largest branch of the profession--is for rapid growth through the 1970's. Newer areas of work, such as atomic energy, aerospace development, and environmental control, will probably provide additional openings for large numbers of mechanical engineers.

## OPPORTUNITIES FOR ADVANCEMENT

As in other areas of engineering, there are managerial and other advancement opportunities.

## SPEECH PATHOLOGIST AND AUDIOLOGIST

### USUAL DUTIES

The inability to speak or hear clearly is a severe hardship to persons of all ages. Children who have difficulty speaking or hearing usually are unable to play freely with others or to participate fully in normal classroom activities. Adults suffering from speech or hearing impairments often face problems of job adjustment. Speech pathologists and audiologists help persons having such disorders by identifying and evaluating their problems and by providing treatment. In addition, they may conduct research in the speech and hearing field. Some are engaged in training programs in speech pathology and audiology at colleges and universities.

Speech pathologists are concerned primarily with speech and language disorders and audiologists with hearing problems, Speech and hearing, however, are so interrelated that to be competent in either of these occupations, one must have a familiarity with both. The speech pathologist works with children and adults who have speech, language and voice problems resulting from brain injury, cleft-palate, mental retardation, emotional problems, foreign dialect, or other causes. The audiologist also works with children and adults, but concerns himself primarily with the assessment and treatment of hearing problems such as those caused by certain otological or neurological distrubances.

The duties performed by speech pathologists and audiologists vary with their education, experience, and employment setting. In a clinical capacity, they identify and evaluate speech and hearing disorders using various diagnostic procedures. This is followed by an organized program of therapy, with the cooperation of other specialists, such as physicians, psychologists, social workers, physical therapists, counselors, and teachers. Some perform research work, which may consist of investigating communicative disorders and their causes and improving methods for clinical services. Others may supervise clinical activities or perform other administrative work.

Speech pathologists and audiologists working in colleges or universities provide instruction in the principles and bases of communication, communication disorders, and clinical techniques. Many also participate in educational programs for physicians, nurses, teachers, and other professional personnel. In addition, they may work in university clinics and conduct research, usually at university centers.

## CHARACTERISTICS OF THE JOB

Approximately 22,000 persons were employed as speech pathologists and audiologists in 1970. Women represented about three-fourths of the total employment. The majority of speech pathologists and audiologists work in public school systems. Colleges and universities employ the next largest number of these specialists in classrooms, clinics, and research centers. The remainder are distributed among hospitals, rehabilitation and community speech and hearing centers, state and federal government agencies, industry, and private practice.

## QUALIFICATIONS

Although only a few states presently have such a requirement, a master's degree in speech pathology or audiology or its equivalent is being stressed increasingly as the minimum educational standard for employment in public school systems. In addition, many federal programs, such as Medicare and Medicaid, require that speech and hearing services be given by, or under the supervision of, a speech pathologist or audiologist holding a master's degree.

Undergraduate training in speech pathology and audiology should include course work in anatomy, biology, physiology, physics, and in other related areas such as linguistics, semantics, and phonetics. Some specialized Course work in speech and hearing, as well as in child psychology and psychology of the exceptional child, also is helpful. This training is usually available at colleges and universities offering a broad liberal arts program.

Graduate education in speech pathology and audiology was offered at 203 colleges and universities in 1970. Professional preparation at the graduate level involves extensive training in the fundamental areas of speech and hearing, including anatomy and physiology, acoustics, and psychological aspects of communication; the nature of speech and hearing disorders; and the assessment, evaluation, and analysis of speech production, language abilities, and auditory processes, as well as familiarity with various research methods used in studying speech and hearing. Persons who wish to work in public schools should complete not only the education and other requirements necessary for a teacher's certificate in the state in which they wish to work, but also may have to fulfill special requirements, prescribed by some states, for people who are going to work with handicapped children.

Speech pathologists and audiologists should have an interest and liking for people, and the ability to approach problems with objectivity. To work effectively with persons having speech and hearing disorders, one must be sensitive, patient, and have emotional stability.

## EMPLOYMENT PROSPECTS

Employment opportunities for speech pathologists and audiologists who have completed graduate study are expected to be good through the 1970's. Although some positions will be available for individuals having only the bachelor's degree, the increasing emphasis being placed on the master's degree by federal agencies and state governments will limit opportunities at the bachelor's level.

## OPPORTUNITIES FOR ADVANCEMENT

Many experienced speech pathologists and audiologists in educational institutions supplement their regular salaries by incomes from consulting, special research projects, and writing books and articles.

In 1970, the annual starting salary in the federal government for speech pathologists and audiologists who had completed all requirements for the master's degree was $9,881. Those having doctoral degrees were eligible to start at $13,493.

# PHYSICIST

## USUAL DUTIES

The flight of astronauts through space, the probing of the oceans' depths, or even the safety of the family car depend on research by physicists. By determining basic laws governing phenomena such as gravity, electromagnetism, heat flow, and radioactivity, potential difficulties can be anticipated and overcome.

Physicists observe and analyze various forms of energy, the structure of matter, and the relationship between matter and energy. From their research, physicists develop theories and discover fundamental laws that describe the behavior of the forces at work within the universe. Physicists have contributed to scientific progress in recent years in areas such as nuclear energy, electronics, communications, and aerospace.

Nearly three-fifths of all physicists are engaged in research and development. Some conduct basic research to increase scientific knowledge with only secondary regard to its practical applications.

About one-fifth of all physicists teach in colleges and universities. Approximately another fifth are engaged in management and administration, especially research and development programs. A small number work in activities related to the production of industrial products such as inspection and quality control. Some physicists do consulting work.

Most physicists specialize in one or more branches of the science--mechanics, thermal phenomena, high energy physics, optics, acoustics, electromagnetism, electronics, atomic and molecular physics, nuclear physics, physics of fluids, solid-state physics, or classical theoretical physics. They may concentrate in a subdivision of one of these branches. For example, within solid-state physics they may specialize in ceramics, crystallography, or semiconductors, among others.

Physicists often apply the theories and methodology of their science to problems originating in other sciences, including astronomy, biology, chemistry, and geology. Growing numbers of scientists specialize in fields that combine physics and a related science. Thus, a number of specialties have developed on the borderline between physics and other fields--astrophysics, biophysics, chemical physics, and geophysics. Furthermore, the practical applications of physicists' work have increasingly merged with engineering.

## CHARACTERISTICS OF THE JOB

Approximately 48,000 physicists were employed in the United States in 1970; nearly 4 percent were women. Private industry employed more than 18,000; two-fifths of whom worked in the electrical equipment, ordnance, and chemicals industries. Commercial laboratories and independent research institutes employed more than one-fourth of the physicists in private industry.

Physicists were employed in all states. However, their employment was greatest in those areas having industrial concentrations and large colleges and universities.

## QUALIFICATIONS

A bachelor's degree with a major in physics is generally the minimum entrance requirement for young people seeking careers as physicists. Graduate training is required for many entry positions and is helpful for advancement in all areas of work.

A doctors's degree usually is required for full faculty status at colleges and universities. Also, the doctorate generally is needed for employment in positions involving responsibility for research and development with any type of employer.

Physicists having master's degrees qualify for many research jobs in private industry, educational institutions, and government. Some also instruct in colleges and universities. Usually, graduate students working toward a doctor's degree are assigned to teach elementary college courses, conduct laboratory sessions, or assist senior faculty members on research projects.

Physicists having bachelor's degrees qualify for a variety of jobs in applied research and development work in private industry or the federal government. Some become research assistants in colleges and universities while working toward advanced degrees. Many persons having a bachelor's degree in the sciences do not work as physicists but enter nontechnical work, other sciences, or engineering.

Students planning a career in physics should have an inquisitive mind, good memory, and imagination. Perseverance and the ability to concentrate on detail also are important. The occupation requires constant study and the ability to work independently. Prospective physicists should also possess good eye-hand coordination and eyesight.

## EMPLOYMENT PROSPECTS

Employment opportunities for physicists are expected to be favorable through the 1970's. In addition to opportunities resulting from the rapid growth expected in this field, other physicists will be needed each year to replace those who transfer to other fields of work, retire, or die.

Graduate training is increasingly the hallmark of full professional status in physics. As in recent years, a demand is expected for physicists who have advanced degrees to teach in colleges and universities. Among the factors contributing to the demand for physics teachers are the rapid increase in graduate enrollments and the growing need for physics training in other science and engineering programs.

New graduates also will find opportunities in other occupations that utilize their training. For example, they may become high school teachers, provided they complete the required professional educational courses and obtain a state teaching certificate. However, they are usually regarded as teachers rather than as physicists.

## OPPORTUNITIES FOR ADVANCEMENT

Physicists having master's degrees received starting salaries about $1,900 higher than those having bachelor's degrees who received about $9,900. Depending on specialty and experience, graduates having Ph.D. degrees generally received entrance salaries of around $15,000 annually, although some were paid considerably less.

Depending on their college records, physicists having bachelor degrees and no experience could start work in the federal government in 1970 at either $8,292 or $10,258. Beginning physicists who had completed all the requirements for the master's degree could start at $10,258 or $11,526. Physicists having the Ph.D. degree could begin at $13,096 or $14,192.

# NATURAL RESOURCES AND ENVIRONMENT OCCUPATIONAL TITLES

AIR

CHEMICALS AND RADIATION

FISH

HEALTH

LAND USE

MINERALS AND MINERAL FUELS

NOISE

PARKS AND NATURAL AREAS

RANGE

RECREATION

SOIL

SOLID WASTE

WATER

WILDLIFE

SELECTED OCCUPATIONAL TITLES

IN

AIR

1. Air pollution control worker
2. Air monitoring technician
3. Smoke tester
4. Compliance section technician
5. Engineering section technician
6. Air pollution control supervisor
7. Air pollution control meteorologist
8. Air pollution control chemist
9. Air pollution control engineer
10. Air pollution control aide

SELECTED OCCUPATIONAL TITLES

IN

CHEMICALS AND RADIATION

1. Spray applicator - ground or aerial
2. Agricultural chemist
3. Chemical technician
4. Agricultural advisor
5. Sprayer helper
6. Spray foreman
7. Field advisor
8. Life scientist
9. Chemist
10. Radiologic technologist
11. Biochemist
12. Occupations in atomic energy

SELECTED OCCUPATIONAL TITLES

IN

FISH

1. Fish hatchery worker
2. Fish farmer
3. Frog farmer
4. Alligator farmer
5. Crab farmer
6. Conservation patrolman
7. Fish culturist
8. Fish hatchery superintendent
9. Fisheries scientist
10. Fisheries technician

SELECTED OCCUPATIONAL TITLES

IN

HEALTH

1. Veterinarian's aide
2. Veterinarian
3. Sanitarian
4. Livestock inspector
5. Various animal and poultry specialists
6. Laboratory technician - veterinary
7. Medical laboratory worker
8. Licensed practical nurse
9. Registered nurse
10. Medical assistant

SELECTED OCCUPATIONAL TITLES

IN

LAND USE

1. Surveyor's assistant, rodman or chainman
2. City planning aide
3. Urban planning technician
4. Zoning inspector
5. Zoning technician
6. Chief planner
7. City planning engineer
8. Urban planner
9. Regional planner
10. Land use planner
11. Architectural engineer
12. Planning aide
13. Planning technician

SELECTED OCCUPATIONAL TITLES

IN

MINERALS AND MINERAL FUELS

1. Mining area restoration worker
2. Open pit mine conservation inspector
3. Mining area restoration technician
4. Scout
5. Petroleum geologist
6. Mineralogist
7. Geologist
8. Geophysicist
9. Oil and gas inspector

SELECTED OCCUPATIONAL TITLES

IN

NOISE

1. Acoustical engineers
2. Agricultural engineers
3. Mechanical engineers
4. Physicists
5. Biomedical engineers
6. Industrial engineers
7. Audiologists

SELECTED OCCUPATIONAL TITLES

IN

PARKS AND NATURAL AREAS

1. Grounds keeper
2. Park caretaker
3. Park worker
4. Recreational development technician
5. Waterways patrolman
6. Park foreman
7. Park naturalist
8. Park superintendent
9. Campground caretaker
10. Park naturalist

SELECTED OCCUPATIONAL TITLES

IN

RANGE

1. Pest control worker
2. Sprayer
3. Range aide
4. Range allotment official
5. Range technician
6. Range manager
7. Range conservationist
8. Range scientist

SELECTED OCCUPATIONAL TITLES

IN

RECREATION

1. Grounds keeper
2. Park caretaker
3. Park worker
4. Recreation farm manager
5. Dude ranch manager
6. Hunting and fishing guide
7. Recreational development technician
8. Fish and game club manager
9. Winter sports manager
10. Ski patrolman
11. Waterways patrolman
12. Park foreman
13. Park naturalist
14. Park superintendent

SELECTED OCCUPATIONAL TITLES

IN

SOIL

1. Surveyor's assistant, rodman or chainman
2. Soil conservation aide
3. Soil conservation technician
4. Engineering technician (soil conservation)
5. Soil scientist
6. Agrogeologist (soil mapper; soil surveyor)
7. Soil fertility expert
8. Soil bacteriologist
9. Soil conservationist
10. Drainage design coordinator
11. Drainage design engineer

SELECTED OCCUPATIONAL TITLES

IN

SOLID WASTE

1. Garbage collector
2. Sanitary landfill manager
3. Sanitary landfill assistant
4. Incinerator operator
5. Recycling plant manager
6. Waste treatment operator
7. Waste disposal man

SELECTED OCCUPATIONAL TITLES

IN

WATER

1. Water filter cleaner
2. Waste water disposal worker
3. Irrigator
4. Irrigation technician
5. Watershed tender
6. Public health engineering aide
7. Sanitarian aide
8. Water and waste treatment plant operator
9. Stream sanitation technician
10. Oceanographic technician
11. Ocean water pollution technician
12. Oceanographic laboratory technician
13. Drainage design coordinator
14. Irrigation engineer
15. Water quality chemist
16. Geological oceanographer
17. Public health bacteriologist
18. Drainage design coordinator
19. Drainage design engineer
20. Water resource investigator
21. Hydrologist
22. Well water inspector
23. Oceanographer

SELECTED OCCUPATIONAL TITLES

IN

WILDLIFE

1. Game farm worker
2. Gamekeeper
3. Animal shelter keeper
4. Wildlife technician
5. Game warden
6. Game propagator
7. Wildlife biologist

# CONTENT OUTLINE
# OF
# JOB FAMILIES

CONTENT OUTLINE OF JOB FAMILIES

Note: This content outline is designed to give teachers a greater knowledge base regarding the job families of natural resources and environment.

I. Job Family - Air

A. Major areas

1. Chemistry
2. Physics
3. Engineering
4. Mathematics

B. Primary functions

1. Monitor air
2. Control air pollution
3. Set and enforce air standards
4. Project future air pollution trends

C. Competencies required for the job

1. Knowledge of chemistry and ability to identify various particulates
2. Knowledge of physics and especially filtering methods
3. Knowledge of design of anti-pollution devices
4. Human relations skills

II. Job Family - Chemicals and Radiation

A. Major areas

1. Chemistry
2. Physics
3. Biology
4. Zoology
5. Plant Science
6. Nuclear Physics

B. Primary functions

1. Provide chemicals and information on chemicals
2. Provide energy from nuclear sources
3. Manufacture instruments involving X-ray
4. Do research in X-ray and atomic power

C. Competencies required for the job

1. Be able to perform well both manually and mentally
2. Be able to follow directions
3. Operate equipment
4. Clearly transmit facts and observations

III. Job Family - Fish

A. Major areas

1. Biology
2. Zoology
3. Animal science
4. Water
5. Chemistry
6. Mathematics
7. Genetics

B. Primary functions

1. Installing and maintaining tanks and traps
2. Spawning and hatching fish
3. Caring for fry
4. Preparing feed
5. Feeding fish
6. Improving ponds

C. Competencies required for the job

1. Knowledge of fish anatomy and classification
2. Understanding of fish histories and the interrelationships between fish and environment
3. Ability to use fish hatchery equipment
4. Ability to use laboratory equipment
5. Ability to keep neat and accurate records

IV. Job Family - Health

A. Major areas

1. Sanitation
2. Water pollution
3. Air pollution
4. Waste disposal
5. Zoology
6. Chemistry
7. Microbiology and parasitology

B. Primary functions

1. Control and prevention of water pollution
2. Providing clean water for domestic use as well as industrial and recreational purposes
3. Identification and control of air pollution
4. Minimize risks in using nuclear energy
5. Work on refuse disposal problems
6. Control contamination and adulteration of food
7. Proper use of pesticides
8. Insuring good housing
9. Insuring maintenance of sanitary regulations

C. Competencies required for the job

1. High degree of common sense and patience
2. Understanding of environment
3. Desire to promote better health conditions
4. Good work habits
5. Good communication
6. Ability to record, analyze, interpret, and transmit facts and ideas persuasively
7. Ability to follow rules and work independently or under supervision
8. Honesty, integrity, and an understanding of the political and economic implications of their positions

V. Job Family - Land Use

A. Major areas

1. Drafting
2. Mapping
3. Government
4. Economics
5. Sociology
6. History
7. Soils

B. Primary functions

1. Data research - population, land use, etc.
2. Interviewing - survey of traffic flow, housing, etc.
3. Field work - conduct meetings between landlords and tenants, etc.

C. Competencies required for the job

1. Interest in people
2. Human relations skills
3. Ability to cooperate
4. High degree of drawing accuracy
5. Ability to be thorough

VI. Job Family - Minerals and Mineral Fuels

A. Major areas

1. Geology
2. Chemistry
3. Engineering
4. Conservation

B. Primary functions

1. Locate minerals and mineral fuels
2. Extract minerals and mineral fuels
3. Refine minerals and mineral fuels
4. Transport minerals and mineral fuels

C. Competencies required for the job

1. Good physical condition
2. Ability to operate machinery
3. Ability to keep records
4. Skills in mapping and drafting

VII. Job Family - Noise

A. Major areas

1. Engineering
2. Physics
3. Biology

B. Primary functions

1. Measuring sound
2. Controlling sound
3. Measuring effects of sound

C. Competencies required for the job

1. Knowledge of acoustics
2. Ability to use instruments
3. Ability to work with people
4. Ability to do research

VIII. Job Family - Parks and Natural Areas

A. Major areas

1. Soils
2. Botany - Plant Science
3. Landscaping
4. Entomology
5. Surveying

B. Primary functions

1. Be in charge of day-to-day park operations and maintenance
2. Make landscape plantings
3. Grounds maintenance
4. Give information to tourists
5. Write reports

C. Competencies required for the job

1. Mechanical ability
2. Ability to work with plants
3. Ability to work well with others
4. Ability to prepare reports
5. An interest and appreciation of nature and the outdoors

IX. Job Family - Range

A. Major areas

1. Biology
2. Botany
3. Agriculture

B. Primary functions

1. Planting, seeding, and fertilizing
2. Spraying
3. Road building
4. Fire fighting
5. Counting animals
6. Fencing
7. Managing, protecting, and developing rangelands

C. Competencies required for the job

1. Good physical condition
2. Mechanical ability
3. Ability to use map and surveying equipment
4. Ability to operate farm machinery
5. Understanding of multiple use
6. Understanding of basic environmental concepts

X. Job Family - Recreation

A. Major areas

1. Natural sciences
2. Group leadership
3. Program planning and organization
4. Health and safety
5. Sports
6. Animal science
7. Arts and crafts

B. Primary functions

1. Administer physical, social and cultural programs
2. Study recreational needs of individuals and communities
3. Provide instruction in sports, arts and crafts
4. Serve as a hunting, fishing or hiking guide

C. Competencies required for the job

1. Must be in good physical condition
2. Must know and be able to live in the out-of-doors
3. Must know sports, arts and crafts and/or hunting and fishing laws, rules and equipment
4. Ability to get along with people

XI. Job Family - Soil

A. Major areas

1. Soil science
2. Plant science
3. Mapping
4. Geology

B. Primary functions

1. Identifying soil types
2. Mapping soils
3. Working with soil conservation districts
4. Making presentations about soils and conservation
5. Surveying
6. Developing soil conservation plans
7. Carrying out soils research

C. Competencies required for the job

1. Enjoyment of working out-of-doors
2. Knowledge of soils
3. Ability to map
4. Ability to survey
5. Ability to speak and write effectively
6. Knowledge of cropping requirements
7. Knowledge of building requirements
8. Ability to do research

XII. Job Family - Solid Waste

A. Major areas

1. Physics
2. Chemistry
3. Engineering

B. Primary functions

1. Operate incinerator or other disposal equipment
2. Manage a sanitary landfill operation
3. Operate a recycling plant
4. Collect solid waste

C. Competencies required for the job

1. Mechanical ability
2. Ability to operate equipment such as a truck and bulldozer
3. Ability to identify various kinds of solid waste

XIII. Job Family - Water

A. Major areas

1. Chemistry
2. Engineering
3. Physics
4. Soils
5. Forestry

B. Primary functions

1. Testing water
2. Storing water
3. Protecting water
4. Treating water
5. Studying plant and animal life in water

C. Competencies required for the job

1. Ability to test water
2. Working knowledge of water holding structures
3. Knowledge of watersheds, grass waterways, and other methods of controlling runoff
4. Knowledge of water and waste water treatment
5. Knowledge of and interest in marine and microscopic life

XIV. Job Family - Wildlife

A. Major areas

1. Zoology
2. Biology
3. Botany
4. Animal science
5. Communication
6. Forestry
7. Wildlife management
8. Ecology
9. Conservation

B. Primary functions

1. Hatching, brooding, feeding and caring for game species
2. Developing habitat for wildlife
3. Explaining and enforcing fish and game laws, rules and regulations
4. Releasing game species
5. Researching wildlife, tagging, etc.

C. Competencies required for the job

1. Ability to hatch, brood, feed and care for wild species
2. Ability to develop good wildlife habitat
3. Knowledge of and ability to explain fish and game laws, rules and regulations
4. Ability to do wildlife research

# PUBLISHING COMPANIES

## ADDRESSES OF PUBLISHERS

Note: These addresses are furnished to allow teachers to contact the different publishing companies if the need arises. The addresses of most of the publishing companies cited in the guide are included.

Allyn and Bacon
Boston
Massachusetts

Farm Quarterly, The
22 East 12th Street
Cincinnait, Ohio 45210

Ferguson Publishing Company
Chicago
Illinois

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